Thos. M. Jenkins

MOOD IN RELATION TO PERFORMANCE

BY

ELIZABETH T. SULLIVAN, Ph. D.

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Mood in Relation to Performance

INTRODUCTION

Brief Summary of Some Definite Contributions to the Literature

Temperament is a general term for the characteristic emotional state of individuals. The traditional classification of temperaments is into the sanguine, melancholic, choleric and phlegmatic. The sanguine and the choleric are supposed to be subject to rapid alternation of interest. With the choleric, interest is intense while it lasts whereas with the sanguine it is relatively feeble. The interest of the melancholic and of the phlegmatic is persistent when once it is aroused, though they are not easily excited. The interest of the melancholic is intense whereas that of the phlegmatic is lacking in vividness.[1]

The ancient and medieval schools of medicine were dominated by two theories, one that human lives were influenced by the planets and the other that all diseases were due to the excess or defect of one of the four humors—yellow bile or choler, black bile, blood and phlegm.[31] These physicians have left records that showed them to be shrewd observers, the evidence of recent times going far to confirm their observations that mental qualities do tend to occur in groups, the total mental constitution of a man being termed his temperament. Though a temperament is not always present in its purity or in a high degree, yet where it is present, the person who possesses it presents a likeness in mental characteristics to another such as is rarely presented by the different members of a single family.

According to Davenport[8] temperament is inherited, periodic outbursts of violent temper being a Mendelian dominant. He has worked out formulae for expressing the possibilities in the inheritance of choleric, cheerful, phlegmatic, melancholic and nervous temperaments and their various combinations.

A. In recent years much prominence has been given to the part played by the bodily states in producing exciting emotion.

The evident connection between the visceral disturbances and the psychic states is admitted by practically all but there is division of opinion as to the manner of connection. This suggests at once the theory of James,[15] which is that the bodily changes follow directly the perception of the exciting fact and that the feeling of these same changes as they occur *is* the emotion. Lange[15] and Sergi[23] hold that the basis of *all* feeling and emotion is physiological, visceral and organic and is located in the vasomotor system.

Sherrington[23] made some tests of this view by experiment. He chose for his subject a "markedly temperamental" dog and made spinal and vagal transections which cut off completely and immediately the sensation of the viscera and of the skin and muscles beyond the shoulder. The procedure at the same time cut from connection with consciousness the whole of the circulatory apparatus of the body. As a result of careful experimenting on the dog in this condition he concludes: "We may with James accept visceral and organic sensations and the memories and associations of them as contributory to primitive emotions but we must regard them as reinforcing rather than initiating the psychosis. Organic and vascular reaction, though not the actual excitant of emotion, strengthens it." He further states that we are forced back toward the likelihood that visceral expression of emotion is secondary to the central action occurring with the psychical state.

Cannon[3] has conducted a series of investigations in the Harvard Physiological Laboratory concerned with the bodily changes which occur in conjunction with pain, hunger, and the major emotions—fear and rage. A group of remarkable changes in bodily economy has been discovered all of which indicate that the bodily changes are responses that are adapted to the individual's welfare and preservation. Digestion is affected to an important degree by feelings. Pleasant taste and smell and sight of food clearly stimulate the digestive processes to action. On the other hand pain and great emotional excitement interfere seriously with the starting of the process or its continuation after it has been started. These effects extend to the entire alimentary canal, effectively stopping the gastric and intestinal peristaltic action both in man and in lower animals. That the mere sight or smell of favorite food may start the pouring out of gastric juice was noted many years ago by Bidder[3] and Schmidt[3] in a hungry dog

which had a fistulous opening through the bodily wall of the stomach. The observation, reported in 1852, was confirmed later by Schiff and also later by Pavlov[8] of Petrograd through admirably worked out experiments on dogs.

Other experiments have been undertaken to determine the part played by adrenalin since the action of the sympathetic division of the nervous system under pain, fear and rage is similar to that produced by adrenalin. When adrenalin is injected into the blood it will cause the pupils to dilate, the hair to stand erect, the blood vessels to be constricted, the action of the alimentary canal to be inhibited and sugar to be liberated from the liver. According to Cannon, "every one of the visceral changes noted—the cessation of processes in the alimentary canal (thus freeing the energy supply for other parts) ; the shifting of blood from the abdominal organs, whose activities are deferable, to the organs immediately essential to muscular exertion (the lungs, the heart, the central nervous system) ; the increased vigor of contraction of the heart; the quick abolition of the effects of muscular fatigue; the mobilizing of energy-giving sugar in the circulation—every one of these visceral changes is directly serviceable in making the organism more effective in the violent display of energy which fear or rage or pain may involve."[6]

Following Darwin's conclusions, Crile[7] makes the assumption that the discharge of nervous energy is accomplished by the laws of inheritance and association. He maintains that "man is a unified mechanism responding in every part to the adequate stimulus given it from without by the environment of the present and from within by the environment of the past the record of which is stored in part in cells throughout the mechanism but especially in the central battery—the brain." On the basis of the mechanistic theory he explains emotions as "ractivations of the entire motor mechanism for fighting, for escaping or for preserving the species." The significant thing here is not so much the theory as the actual observations on which the theory is based. As to the actual physiological results of emotion both Crile and Cannon agree that in fear all the motor mechanism is correlated for combat, the non-combatant organs being inhibited.

Closely connected with temperament and personality are the internal secretions[10] and the ductless glands[16] which give rise to them. Investigations in this field are strengthening the

opinion that the human organism is a "moving chemical mixture" dominated by the action and interaction of eight or ten ductless glands. The personality or temperament is thought to be due largely to the action of these glands and the degree of balance established between them. When for any reason the balance is disturbed between the system of glands disease is the result. Although the investigations of the endocrinologists are becoming increasingly prominent more need not be said about them here beyond this brief recognition of the importance of their findings to any study directly or remotely connected with temperament and personality.

B. The remaining works to be reviewed have been selected from the literature dealing with the investigation of the personality because of the definite nature of the study and the value of the method employed. Ach's work on Will[1] and Temperament, apart from the method used, is important because of the problems it presents for future development. The object of this study was to find a measure of the strength of will, the efficiency of the will being the relation of the actual results to the intended results. In any test the results might be missing, they might be changed in form or delayed. He used in combination the Saving Method, Repetition, and Paired Associates to present definite tasks to the subjects. Inner obstacles in the nature of previously formed habits were set up to interfere with the carrying out of the undertaking. These obstacles were of different strength and by the methods used the strength of the various habits could be determined. By the formation of habits of different strengths which would act as obstacles, Ach believed he could bring out weak and strong impulses, efficiency (besides other factors) depending on the strength of the determining tendency.

The work of Webb on Character and Intelligence represents an attempt at an exact study of character. The author's holds that there are two aspects to intelligence, one a general factor of mental energy, G—some general factor of the cortex— on which all performances depend, and a second factor W, prominent on the character side of mental activity as distinguished from the purely "intellective" side. He includes under intelligence all those qualities which are especially related to mental performances. Under character he includes volitional social and moral qualities. His subjects were 98 second year students at a training college in London, average age being

21 years, a similar group of 96 other students, who constituted the class the following year, and 4 groups of school boys about 12 years old. His method was that of group judgment, the judges being 20 prefects and 4 class-masters of the school. Each judge estimated each subject as to certain intellectual and character qualities, two judgments being secured from each judge on each quality to obtain reliability. The marks were given under conditions controlled to shut out any bias. The subjects were ignorant of the fact that the experiment was being carried on. The judgments were given with regard to the individual as a whole. On the basis of the estimates thus secured the investigator concludes: "We may say that the possession of a good deal of G, i.e., of pure intellectual ability (1) is revealed in most attempts to estimate intelligence qualities and (2) tends to occur in persons with stability of emotions, some cheerfulness added to a fair degree of sociability, with marked application to duty and some foresight and perseverance." The investigator attempts to show statistically that the factor G is functionally operative in producing correlation between mental performances, the correlation being always partly due to the G and partly due to specific abilities called into play by the specific nature of the performance, i.e., to the existence of a second general factor, W. on the side of character. He made a study of these character qualities using precisely the same method he used for the purely intellectual factor. He found that "stable qualities" of character correlated more highly with "profoundness estimates" and that the "unstable qualities" correlated best with "quickness." The nature of the second general factor W is closely related to "persistence of motives" and according to Webb is not unlike Ach's 'will.' He further states that "the theory of the second factor, persistence of motives, seems to be in good accordance with the system of relations which are exhibited by the two aspects of intelligence" for "profound intelligence, as distinguished from mere quickness may be regarded as being a steadier or more stable grasp of the mental content.' The investigation represents a definite attempt to study character in connection with intelligence and suggests a method of work that is of more than ordinary value.

Studies on judgment have furnished methods that are important if not indispensable in any investigation of character or temperament. Cattell's[4] study of American men of science

was an attempt to find a relation between the character of an individual and the way he expresses himself. He had ten judges for each science to judge the men in each branch of science. The judges were all prominent in the scientific field. The judgments were arranged in the order of merit, the investigator taking the P. E. as measuring the validity of the various judgments. If any man's average position varied from that of another by three times the P. E. there was no chance that the two men's places would be interchanged.

Hollingworth[11] made an experimental study of the characteristics of judgments of personal efficiency and the relation between judgment of one's own performance and judgment of the work of another person. He found that "judgments of one's own work tend to be only slightly better, from the point of view of correctness, than judgments of the work of another person." From the results of "An Experimental Study of Self Analysis," in which the same author collaborated with Cogan and Conklin, it appears that in general "the error of self-estimation tends to be half again as great as the average error of the judgments of associates," and in the long run a person who knows himself best is the best judge of others, or at least, tends to be a good judge (varying with the trait in question). Furthermore, there seems to exist a considerable degree of correlation between academic record and mental tests and the ability to judge.

A very recent study by Rugg emphasizes certain conditions that are essential to validity in judgment ratings. The independent judgments of three judges are necessary; the rating scales must be comparable and equivalent and the judges must be competent to rate. In the opinion of the author even with these three provisions judging methods are subject to a large error. In his own scale all three provisions are met. While he inclines to the belief that all rating scales are only relative he thinks that it is better to use the objective method of measuring than to attempt to improve the subjective methods in use.

A recent addition to tests of personality is the Pressey Crossing-out Test[20] devised for the investigation of emotional interests and distractibility. A part of the test is designed as a "measure of affective spread or tendency to emotionalize." Another is designed for measuring emotional distractibility, the test consisting of crossing out irrelevant words "sown"

into two paragraphs, one of commonplace matter and the other of matter calculated to excite emotion. The idea being that the emotional excitement of the second paragraph would cause the subject to overlook more irrelevant words, the difference between the scores of the two paragraphs becomes the measure of "emotional distractibility." A third part of this group scale is constructed to measure "moral discrimination and experience" and is derived directly from the Kent-Rosanoff tests for association in insanity. A fifth part of the scale is intended to measure"emotional memory" two lists of words being given to test memory for emotional words compared with that for unemotional words. The test as a whole is designed to meet the conditions required in a group test, the "crossing out" feature making it easy to give and to score. Thus far the literature reviewed has dealt with the subject of emotion in a general way, and with studies that have furnished something in the way of method bearing more or less directly on the treatment of the data used in the study with which the writer is concerned.

C. The immediate predecessors, however, to this study of mood and performance are some recent investigations in which performance is studied in relation to other conditions. The investigation made by Dr. L. S. Hollingworth[14] of Functional Periodicity and its effect on the mental and motor abilities of women is one of these. It covers the traits of voluntary speed of movement, steadiness, speed and accuracy of perception and controlled association all of which were tested under controlled experimental conditions. Contrary to general expectation, the results did not reveal any mental or motor inefficiency in connection with physiological periodicity.

The condition of ventilation in relation to mental work was studied by Thorndike, McCall and Chapman.[27] The object of this extended research was to investigate the effect of certain atmospheric conditions on efficiency. The subjects were tested in various functions under varying external conditions of temperature and humidity and air circulation, the experiment being controlled to eliminate practice and individual difference. The results of the experiment with daily change of air conditions showed that "when a person exerts himself his achievement at mental work is as good under various bad conditions as under the best conditions" (within the limits of the experiment). The part of the experiment having to do

with the rate of improvement made under prolonged bad and good conditions showed that the "improvement made during the week of a bad condition was equal to the improvement made during a best condition week." A third part of the experiment was concerned with the effect of the condition of air on mental work when the "instruction of the experiment, the conduct of the experiment and the nature of the tests were such as not to stimulate effort but to encourage carelessness." Work was done under conditions of bad air, and made "intentionally drearily monotonous and barren of interest," but still showed no inferiority in quality to that done under contrasting conditions.

Dr. Lorle I. Stecher made a similar study on the "Effect of Humidity on Mental Efficiency." This extended experiment was conducted under equally controlled conditions. The results as in the case with ventilation were negative indicating that "behavior or product per unit of time is not affected to any extent by varying degrees of humidity." Another study by Thorndike[28] on fatigue in school children is of especial interest here. The purpose of this study was to test the ability to do mental work before and after periods of hard mental exercise. The greater number of "after-work" tests were undergone when the subjects, if left to themselves, would not have engaged in mental work. Professor Thorndike says, "The children in the schools where I gave tests early and late in the day agreed that they were tired in the late hours and thought that they could not work nearly so well yet these same children *did* do just as well in the tests given. The relation between the feeling and the fact of fatigue then is not a simple relation of direct dependence but a very involved relation or series of relations." He concludes that "we can *feel* mentally fatigued *without being* so. Feelings of being 'mentally tired' serve as signs to us to stop working before our actual ability to work has suffered any important decrease."

The three studies just reviewed represent efforts made to study performance under conditions that involve a temporary disinclination to work. The remaining studies represent efforts made to study performance in relation to a diseased condition of some part of the organism.

Wallin[29] in "Mental Health of the School Child," reports the results of a study made on a group of twenty-seven public school children in Marion School, Cleveland, Ohio, all of whom

were handicapped to a considerable degree by diseased teeth or gums or an otherwise unsanitary oral cavity. The experiment extended over one year, corrective treatment of a complete order having been given during the time. Five series of psychological tests, given at stated intervals during the course of the treatment, served as a measure of the effect of dental treatment upon the working efficiency of the pupils. According to this investigator, there was a decided gain in every test and not only were the "gains more frequent than the losses" but the largest gains were invariably "emphatically larger than the largest losses." There was corroborative evidence to show that there was a general "improvement in the mental efficiency of these pupils." Most of the members of this experimental groups were "laggards and repeaters pedagogically retarded in their work from one to four years but during the experiment only one failed of promotion while six did thirty-eight weeks of work in twenty-four weeks and one boy finished two years of work within the experimental year." It is to be noted that no control group was used in this investigation.

A very recent study by A. H. MacPhail shows the effect on school work due to the removal of diseased tonsils and of adenoids. As the result of carefully controlled observations made on thirty-one pupils of the Adams and Cranch Schools, this investigator concludes that the "removal of diseased tonsils and adenoids is a factor in beneficially influencing the mental life of the school child. Not only is the health impaired by failure to remove these diseased parts but mental life and activity of the child as well."

A similar investigation with an additional purpose in view was made by Dr. Margaret Cobb,[5] one part of the work being concerned with the effect of the removal of tonsils and adenoids on efficiency and the other with the effect on the Intelligence Quotient. An extended experiment was carried on, the subjects of which were pupils in Public School 64, Borough of Manhattan, New York City, or patients at the Manhattan Eye, Ear and Throat Hospital. The hypothesis was that if a "child's working efficiency is lowered by the effect of adenoids and bad tonsils then removal should, unless such lowering be permanent, be followed after a reasonable time by an improvement." Care was taken to compare the improvement in efficiency with the change in efficiency of a control group whose

members had not been treated. Observations were made during a period of twelve months following the operation for adenoids and tonsils. Test results for the first six months were compared with those for the last six months and may be summarized as follows: In weight and height there was a slight but not a reliable increase during the first period and no reliable increase in height-age; there was no gain in strength of grip (possibly a decrease) and in speed of tapping. Fatigability was not lessened. During the second period, the results showed a noticeable improvement in weight, height-age and speed of tapping; there was no increase in height, no decrease in strength of grip and no lessening in fatigability.

In addition to the more extended experiment a comparison was made as to the effect of removal of tonsils on the intelligence levels of two groups of children, the one "selected for the presence of tonsils and the other for freedom from them," both groups being selected from Public School 64. There was no rise in the I. Q. as a result of the operation and a group of 236 children with diseased tonsils showed equal distribution of I. Q, with a group of 294 children who were normal in this respect.

Important among this class of investigations on the relation of disease to efficiency is that pursued by the Rockefeller Foundation under the direction of Dr. E. K. Strong[25] with the purpose of examining the effect of hookworm disease on the mental and physical development of children. The children were divided into five groups and tested at intervals of three and one-half months by use of the following tests: Opposites, calculation, logical memory, memory span, handwriting and the Binet-Simon Tests. Before any experimenting was done the children were divided into sub-groups on the basis of performance in a test given for the purpose of obtaining sub-groups that were nearly equal so that improvement could be compared between equal sub-groups. The improvement made by the uninfected group was taken as 100 per cent. By comparison the group "infected but not treated" showed the least improvement, 34 per cent. The children "completely cured of infection" showed an improvement of 60 per cent. The group of "severely infected children, treated but not cured" improved 38 per cent. An older subgroup of "severely infected children treated but not completely cured" improved 9 per cent less than the normal children

and much less than the untreated younger children. Dr. Strong concludes that "hookworm unmistakably affects mental development. Treatment alleviates this condition to some extent, but it does not immediately, at least, permit the child to gain as he would if he had not had the disease." His figures apparently show that "prolonged infection may produce prolonged effects on mentality—effects from which the individual may never recover."

CHAPTER I

THE PROBLEM, METHOD AND RESULTS. A GENERAL STATEMENT

The present study was undertaken with the desire to find out some of the factors that enter into temperament, moods or dispositions and to get some insight into any relation that may exist between mood and physical and mental performance. The subject is a difficult one because of the practically unexplored field of which it is a part, because of the involved nature of temperament itself and because of the few studies made of the subject by methods sufficiently objective in their nature to justify a fair measure of confidence in the results.

It was necessary at the outset to limit the field for investigation and to make a rather intensive study of some phases with the hope not so much of making any definite discovery as to point out what were well to do next and perhaps how *not* to do it. The tests employed were chosen from among those already used by psychologists to measure relatively small differences and which have been found to be susceptible to a wide variety of influences. These tests with slight modification, which will be discussed in detail later, were given to three different groups of individuals aggregating 18 women and 20 men, ranging in age from 20 to 51 with the median at 30 to 32. The tests for each group were given on the same day under uniform conditions for the group, at the same hours (between one o'clock and four o'clock p. m.), by the same person (the writer), and in the same order. Any departure from the order for the group, such as a slight difference in the time of testing any individual, was recorded but in no case did it extend beyond 45 minutes and is negligible.

Group I. The first series of tests began March 24 and ended April 28, 1920. The subjects were 3 women and one man, graduate students working at the time in the Columbia Psychological Laboratory, where this research was planned as part of the requirement of the course. The tests were made individually once a week at the laboratory period, covering a period of six weeks.

The subjects had a general idea of the purpose involved in the experiment and some of them had a preconceived idea that they were likely to prove less efficient when they were feeling below normal in cheerfulness.

Group II. The second series of tests were made on 10 subjects, five women and five men, patients in the Manhattan State Hospital, who had been under treatment for Manic-depression. At the time of the experiment these subjects were in a practically recovered state. Subjects of this type were chosen to take part in the experiment because of their susceptibility to changes in mood, thus insuring (to the experiment) a certain variety of records of mood.

The tests for the women began October 12 and ended November 18, 1920. Those for the men began January 12 and ended February 18, 1921. The tests were given on consecutive days four times a week (on Tuesday, Wednesday, Thursday and Friday), between one o'clock and four o'clock, under uniformly controlled conditions for each group, in the same order and by the same person (the writer). As in series I, any variation in the routine of testing did not extend beyond 45 minutes for any one subject and can be disregarded.

The records for the first week for some subjects were not entirely complete, owing to the necessity of trying out the individuals to determine their willingness and physical and mental fitness to take part in the experiment, and to establish a satisfactory routine. The selections were carefully made by members of the medical staff of the Manhattan State Hospital, who maintained throughout a generous professional oversight of conditions affecting the experiment.

In every instance the subjects were willing and glad to take part in the experiment. They were not aware of the object of it but they brought a peculiar sympathy to the work because of its evident relation to mental conditions. The spirit of all is expressed in the words of one of the subjects: "If it adds to knowledge about the mind, it will be a good thing to do and I'd like to help. It may be useful to other people with mental trouble."

In order to have the final figures represent the results of work done under conditions as nearly uniform as possible the scores secured for the first week were disregarded and those for the five weeks following were used as the basis of calculation.

Group III. The third series of tests began on February 28 and ended May 9, 1921. The subjects were 23 graduate students in psychology, 11 women and 12 men studying the problem of group testing in Columbia University. For this group obviously the tests given to Group I and Group II as individuals had to be modified. (See Chapter II for detailed description of test used and modifications made for Group III). The tests of pulse, blood pressure, strength of grip and accuracy of Touch Discrimination had to be omitted entirely. The Opposites Test was substituted for the Color Naming Test for the study of controlled association and the Free Association Test and the Tapping Test were modified also, to meet the conditions of a group test. These tests were given once a week at the same time of the afternoon, in the same order and by the same person (the writer).

The object of the experiment being to observe if mood was in any way related to performance, the method of rank difference was determined upon as possibly the best to use in the statistical treatment of the data secured in this experiment. Before undertaking the ranking of the scores both for mood and performance it became necessary to devise a method for ranking with a fair degree of certainty the objective marking for mood, and another for eliminating the effect of practice from the actual scores secured by the tests. The methods employed are described in detail in Chapter III. The scores for mood and for performance in each of the tests were correlated and ρ determined by the application of the formula,

$$\rho = 1 - \frac{6 \Sigma D^2}{N (N^2 - 1)}$$

By use of tables[34] values of r corresponding to values of ρ were found.

Summary and Conclusion.

I. The conspicuous feature of this investigation is the low coefficients that result from correlating measures of mood with tests of performance.

2. The results differ widely not only with regard to the performance of the separate individuals but with regard to the individual's performance in the several test.

3. The median coefficients for the three groups, men and

women combined, are practically zero for all of the fifteen tests.

4. The correspondence is fairly close between the actual distribution of the coefficients and the normal distribution for the sexes considered separately or combined in the ten tests that are more definitely tests of performance.

The median coefficient for both men and women is practically zero and the 25 percentile, the 75 percentile and Q are within .31 of zero for the men and women considered separately or combined. Fifty per cent of the coefficients lie between the distance $+1$ Q and -1 Q. The per cent of coefficients that lie within the remaining distances of Q is very close to the per cent of measures included within these distances in the normal curve of distribution.

5. No single test shows a sufficiently marked departure from the normal distribution to conclude that mood had influenced results.

6. There is little to indicate individual differences.

7. If a very marked relation existed between the mood and the performance of the individuals tested it is likely that it would have appeared to a more noticeable extent than it has in the results of this experiment. This statement of the situation is offered:

Extremes of mood act as distractions, the absence of any demonstrable effect on performance being due to the tendency of the individual to overcome resistance by increasing the output of energy.

This concluding statement is supported by the results of the well-known experiment of Morgan's on "Overcoming of Distraction and Other Resistances."[19] This experimenter found that the general tendency was for subjects to make movements of their speech organs as they performed tasks and, furthermore, there was a general tendency to increase these movements as they worked, as shown by the increase in the breathing rate. The subjects who made use of this means of overcoming the distracting effect of noises increased the quality of their performance and those who did not showed no such increase. In the test made on the typewriter it was found that the key pressure records showed that greater effort was exerted through the distraction period. The general tendency was to attempt to overcome distractions by strain and articulation and by these aids performance was kept

pretty well up to normal. In one part of the experiment Morgan observed the relation of time to force by having the subject raise varying weights with as much force as possible. The tendency was for the subjects to keep the time constant, extra force being exerted to meet the change in conditions.

It is common opinion that atmospheric conditions influence efficiency, yet the experiment by Thorndike on ventilation indicates that the individuals do as well in mental work under hot, humid, stale and stagnant air conditions as under the best conditions. The investigation made by Dr. Stecher show that varying degrees of humidity have practically no effect on efficiency. The school children tested by Thorndike after school hours agreed that they were tired, and thought that they could not work nearly so well, yet these same children *did* do just as well in the tests given. Dr. L. S. Hollingworth's investigation of the effect of functional periodicity did not reveal any mental or motor inefficiency in the women tested, contrary to general opinion that temporary discomfort or disinclination to action would tend to influence performance unfavorably.

Hookworm disease, bad tonsils and adenoids are drawbacks to performance, yet the investigations of Dr. Strong and Dr. Cobb do not reveal any marked increase in performance after the condition had been corrected. Equal performance under conditions of disease or temporary physical discomfort calls for increased effort on the part of the individuals. Certain investigators report marked improvement after the removal of tonsils and adenoids. The probability is that the operations resulted in improved health, which meant increased energy, less strain and more easily sustained attention to work.

Disease, temporary physical discomfort and mental fatigue are all conditions of disinclination to action which must be counteracted by voluntary effort if the individual's performance is kept up to normal. An unfavorable mood represents disinclination to action. When this disinclination is overcome by increase in the output of energy the influence on performance is slight.

The subject of mood furnishes a rich field for further experimentation. By way of practical suggestions the writer offers the following: There is a possibility that a truer ranking of mood might be obtained by using a measure that allows

for discrepancies between the objective marking and the subjects' description of their mood, especially where the mood is compared with that of the previous day. The comparison depends on memory and is likely to be somewhat inaccurate. It is possible, too, that more definite results might follow from the use of a limited number of tests covering in each case a longer time. By taking the record for mood at the beginning and end of the limited series of tests, changes of mood during the test would be indicated to some extent. It would be advisable at the outset to provide definite means for differentiating between depression and fatigue, depression and irritability or anger, and between cheerfulness and degrees of nervous excitability.

The experience of the writer in this investigation leads to the opinion that the relation between emotional disturbance and the accuracy of touch discrimination might be studied with profit; also the relation between emotional disturbance and the extent of voluntary movement[33] as measured by the drawing of a line to equal in length a remembered standard.

CHAPTER II

TESTS AND METHODS OF HANDLING DATA

SECTION 1

DESCRIPTION OF THE TESTS USED

The following tests were made in the order indicated below:

1. Measure of Mood.
2. Pulse Rate (Omitted in the group test).
3. Blood Pressure. (Omitted in the group test).
4. The Two Point Threshold. (Omitted in the group test).
5. Muscular Strength. (Omitted in the group test).
6. Line Drawn to Equal in Length a Remembered Standard.
7. Tapping Test.
8. Color Naming Test. (Opposites test substituted in the group test).
9. Addition Test.
10. Free Association Test.

1. Measure of Mood.

At the beginning of each experiment a piece of paper 8 in. x 10 in. was placed on the table in front of the subject. This paper contained a space at the top for the name and date and well down from the top of the paper a horizontal line 10 cm. long drawn in ink. This line occupied the middle of the paper, the margins being exactly equal. The subject was given the following directions: "If the left end of this line represents the lowest degree of cheerfulness you ever feel and the opposite end the highest degree of cheerfulness you ever feel, where on the line are you now in degree of cheerfulness? Draw a line across the scale to indicate where you are today." This line was drawn promptly, following a brief but noticeable introspection period.

The subject was asked to write a short description of his mood in the space below the scale. To this was added the observations and impressions of the operator regarding the physical or emotional condition of the subject at the time of the experiment. This step had to be omitted in the group test.

2. Pulse Rate.

In each case the count was taken at the wrist of the left hand, the subject being seated. For Group I the count was taken for one-half minute and doubled for scoring. For Group II the count was taken for one minute.

3. Blood Pressure.

This measure was taken for Group I and the women of Group II with the Baumanometer. For the men of Group II the Rogers Tycos was used. As the results of this study do not depend on comparisons between individuals but are concerned with the individual's range, any difference that might be due to a change of instrument can be disregarded. In every case the reading was taken with the subject seated and with the left forearm resting on the table, palm up. The stethoscope was placed just above the elbow on the brachial artery. The record for systolic pressure was in every case the *first* loud sound that was heard; for the diastolic the last faint sound that could be heard. In each instance there were two readings for verification.

4. The Two Point Threshold.

For determining the degree of sensitivity a simple aesthesiometer in use in Columbia College Laboratory was selected. It is made of a light weight Bristol board and constructed to admit of easy adjustment. The region tested was the back of the left hand about two inches from the knuckle of the third finger, the points of the aesthesiometer being placed just across the chord passing over the knuckle of the third finger, the strip of board connecting them being at right angles to the chord.

The subject sat opposite the experimenter with his left hand resting on the table, the hand being concealed from view by a screen constructed to stand across the lower forearm but nowhere to touch it. In every case the test began with a distance of two centimeters between the points of the aesthesiometer and this distance decreased gradually until a measure was reached when the responses of the subject began to be uncertain. The method of increasing the distance between the points stimulated was then applied and the smallest measure recorded when the responses were certain, as determined either by the method of increasing or decreasing the distance between the points stimulated.

5. Measure of Muscular Strength.

The arm dynamometer was used for Group I. It was attached to the wall and the subject stood at arm's length from the wall and pulled with his right arm. The use of this apparatus did not prove entirely satisfactory as it allowed for bodily weight to enter into the records, but as the factor entered into all records the results are usable for the group. For Group II the hand dynamometer was substituted for the arm dynamometer. The records were taken in every case with the subject standing and for both right and left hands.

6. Line Drawn to Equal in Length a Remembered Standard.

For securing a measure of the length of line that the subject would draw voluntarily the following method was used. At the time of the first experiment each subject was given a paper, 8 in. by 10 in. and was asked "to draw a line of convenient length anywhere on the paper." The paper was put aside and before the close of the experiment for the first day the subject was given another paper of the same size and grade as before and was asked to "draw a line as nearly equal in length as possible to the line you drew at the beginning of the test." At each test period he was asked to reproduce again the standard line he drew at the time of the first experiment.

7. Tapping Test.

A. For individuals.

The apparatus used for this experiment with Group I and II was the ordinary small tapping board in use in the Columbia Laboratory, connected up with an electric counter and a short metal rod for tapping. The subject sat before the board which was placed on a table, with the small metal rod held in his right hand and his right elbow resting on the table. The instruction was given, "Tap at a comfortable rate." At a signal from the operator he began tapping and continued tapping for one minute, time being kept by the operator with a stop watch, the tapping record being recorded by the electric counter. The time remained constant while the amount varied. It was observed that an occasional *tapping movement* owing to fatigue or lack of control due to other cause was not recorded because the movement fell *just* short of the brass plate. Any unrecorded tapping movement of this nature was kept account of and added to the score read from the electric counter.

B. For the Group.

Group III consisted of twenty-three individuals and this test had to be modified to meet the conditions of a group test and still have the results comparable with those of Group I and II where the tapping test was given as an individual test.

This test was given in the Columbia Psychological Laboratory with the subjects sitting on chairs at the laboratory tables. Before each subject was placed a piece of paper 8 in. by 10 in. on which were drawn ten horizontal lines about an inch apart. The subjects were provided with lead pencils of uniform length and size, selected to match as nearly as possible the metal rod used in the individual tapping test. The subjects were given this simple instruction: "This is to be a tapping test. The paper is your tapping board. The pencil is the tapping rod. Tap at a comfortable rate. As you tap will you tend to work along in either direction between the horizontal lines in order to distribute the dots, thus making the counting of them possible and easy. If this seems to hamper your movements disregard it." At a signal, as in the individual tapping test they began to tap and continued for one minute. The dots were well distributed along between the horizontal lines and taking them section by section, the count was easily made and easily summed. In all respects, in the opinion of the experimenter the test parallels the individual tapping tests, the only exception being the slight effort on the part of the subjects to distribute the dots. The subjects reported that the effort was so slight as to be entirely negligible.

8. Controlled Association.

A. Color Naming Test.

The Color Naming Test is designed to measure the speed with which the name or idea can be brought to consciousness and expressed vocally upon the sight of an object which in this case is a color. The subjects in Group I and Group II were provided with a Woodworth-Wells[32] Color Card, on which are printed in random order one hundred small squares in five different colors. The card was covered by a paper and placed on the table directly in front of the subject. At the first several trials each subject was asked to name the colors in the sample at the top of the card to make sure of his ability to discriminate the five colors. At a signal the operator re-

moved the cover from the card, passing it quickly to the subject's right and the subject began to name the colors as rapidly as possible from left to right. The time was taken with a stop watch to the fifth of a second. Errors, also, were taken account of. In the handling of errors the procedure varies from that generally in use where in the case of any misnaming of a color the subject is stopped and made to return to the point at which the mistake arose, all mistakes being accounted for in the time consumed by them. In the present experiment mistakes were kept account of by the operator, any omission being counted as a mistake. The object here was not only to discover if there was any variation from day to day but to discover in the case of color naming if it was in speed or accuracy. Furthermore, any interruption of the subject to point out his errors would tend to irritate and humiliate him thus introducing into the experiment avoidable complications. This variation seems not to be especially out of harmony with the spirit of the test as given by its authors: "The confusion here is sometimes due to wandering of the attention from the work in hand; but at other times it seems to be due to interferences generated by the performance itself. Whatever may be the cause of confusion in each particular case, efficiency in the test requires such a degree of control as will eliminate the confusion. Periods of confusion are but extreme manifestations of inefficient control; in a minor degree, the efficiency of one individual in comparison with another is shown by uniform slowness of response."[32] The confusion in this test due to whatever cause would be represented in the time taken for the completion of the test. The mistakes were kept account of and constitute a measure of accuracy.

B. Opposites Test.

The subjects of Group III were tested as a group. The Color Naming Test being an individual test, it was necessary to select an equivalent test of controlled association processes that could be administered as a group test. The Opposites Test of Woodworth and Wells[32] was selected. According to the authors this test is a "measure of mental alertness" and of "efficient mental control" and is "apparently the most available material for a test of completely controlled association, with the exception indeed, of the naming test and the arithmetic tests....."

Professor H. L. Hollingworth who has worked extensively with this test says: "This test indicates the ability of the individual to select the appropriate response from a host of ideas which follow in the wake of a stimulus word. It is an index of speed, accuracy, linguistic feeling and of ability to repress useless or irrelevant ideas. It is a test of association processes, but of association processes of a considerably more complex kind than those involved in the color naming."[12] This test then appears to be a fair substitute for the color naming test as a measure of controlled association. The fact that the association processes tested here are of a more complex kind than those brought into play in color naming need not be given much weight. The students who took part in this test were graduate students of psychology whose training doubtless gave them some advantage over the subjects in Group II who took part in the Color Naming Test. They were possibly at a slight disadvantage when compared with the subjects in Group I who also were graduate students in psychology. This group took the Color Naming Test.

The test of Hard Opposites was placed face down on the table in front of the subjects. At a signal the subjects turned the paper over and as rapidly as possible *wrote* the opposite to each word in order. Twenty seconds only were allowed for this test. Preliminary trials with the material indicated that thirty seconds were sufficient for some subjects to finish the test. Allowing for the time that would be gained by practice, twenty seconds semed a safe time to insure that none would exhaust the list before the time set for all. The two lists of Hard Opposites were given in alternation at each experiment period one week apart. The amount of work done and errors were recorded, the time being kept constant.

9. Addition Test.

The *constant increment* test devised by Woodworth and Wells[32] was the material used in making this test. The blank contains 100 two-place numbers arranged in four columns. The subjects of Groups I and II were provided with one column of the numbers. The slip was placed face down on the table before the subject and at the starting signal the subject turned the paper over and added 7 to each of the numbers recording the sum opposite each number in turn. In order to counteract as much as possible the effects of memory and practice, the remaining columns of figures were given in

order at successive test periods. The time taken to complete the column and the errors were recorded. Group III was provided at alternate test periods with half of the same test blank. One minute was allowed for performance. The amount of work done and the errors were recorded.

10. Free Association Tests.

Group I were given the first 25 words of the Kent-Rosanoff Association Test[17] for four successive test periods. The responses came almost automatically and were in every case common reactions. This was due in part to the fact that the subjects were familiar with the test.

Because of the rather wider range of the words included, the Woodworth Wells[32] list for the Free Association Test was used for the other two groups. The first 100 words were used, 25 being given at each test period the same 25 words being repeated at every fourth test period.

With Group I and Group II the stimulus word was pronounced by the operator the subject being required to "say the first word that came to mind other than the stimulus word." The response was recorded by the operator together with the time which was taken by the stop watch to one-fifth of a second. For Group III the procedure had to be varied slightly to meet the requirements of a group test. The subjects were provided with pencil and paper on which were numbered 25 spaces for responses. The stimulus word was given with a rising inflection by the operator and the subjects were required to "*write* the first word that came to mind other than the stimulus word." The stimulus words followed each other at exact intervals of five seconds by the stop watch. If no response came at the end of five seconds the space was left blank. At the end of the test any word not distinctly heard by any individual was repeated in the same manner as before and the response written by the subject, the subject being instructed to star all such words. In this test the time remained the same. The individual reactions are here the significant measure.

SECTION 2

Discussion of Methods of Handling Data. Scores for the Rating of Mood.

In order to preserve objectivity in the rating of mood, the scores were used as marked by the subjects. These scores were determined by measuring the distance in centimeters from the zero end of the scale to the point marked off by the subject as representing his degree of cheerfulness for each experiment period. These scores were placed in order beginning with the lowest and ending with the highest. In case of tying, and there was a fair number of tied scores, resort was made to the verbal description asked for after the subject had marked his mood on the scale. On the basis of these data the scores were ranked by the experimenter. It seemed desirable here, in order to counteract the personal equation in this ranking to secure the benefit of group judgment. The verbal descriptions of mood and the observations and impressions of the experimenter were copied on separate slips of papers, dated and submitted to five other judges, graduate students in psychology, who were asked to rank the tied scores. The judges did not know that the scores *were* tied. The averages of the six judgments were secured and ranked and the ranking was correlated by the method of rank differences with the ranking determined upon by the experimenter on the basis of what the subjects had said and the written record made at the time of the experiment.

In the case of one subject, F, Group II, when two scores were tied the judges' agreement with the writer's ranking was perfect. In another instance the same subject tied four times. There was no agreement and the scores were ranked as tied scores. In the case of Subject Km, Group II, there were three instances when two scores were tied. In all three instances there was perfect agreement between the writer's and the judges' rankings. In the case of Subject L, Group II, where four scores were tied there was perfect agreement. In a second instance of four tied scores by this same subject the agreement was .70. In four other instances when two

scores each were tied five out of the six judges gave the same ranking as the writer. Two scores for Subject S, Group II, were tied. There was perfect agreement among the judges regarding the ranking. The position of several other scores of this same subject were in doubt because of her failure to mark the scale for four days. The agreement here between the judges' arrangement and the writer's was .73. The results indicate a considerable correspondence in the opinion of the judges and also justify a measure of confidence in the method employed for measuring mood.

In two cases in Group II it seemed impossible to secure the marking of the scale to indicate the degree of cheerfulness. The idea of measuring a mental state by a space on a line seemed difficult for these subjects to grasp. Effort was made as the experiment progressed to secure the measure without antagonizing or irritating them but the effort proved unsuccessful to the end. The verbal descriptions given by the subjects of their mood and the experimenter's impressions of mood made at the time were available. With these taken as a basis for judging, the mood for the different days was ranked in order from lowest to highest. Again it seemed desirable in order to counteract the personal equation in the ranking to secure the benefit of a group judgment. The same procedure was followed as in the case of the tied scores, seven judges acting in these two cases. The average ranking of the seven judges when correlated with the ranking previously determined on by the experimenter gave in one case .78 and in the other .82. Subject B, Group II suffered a relapse into a manic state while the experiment was in progress. On recovering he invariably marked the scale at 100. On the basis of his statements and the writer's observations these scores were ranked by the writer. This arrangement correlated with the average rankings of six other judges gave a coefficient of .74. As in the instances of tying these fairly high correlations justify a measure of confidence in the original ranking, based upon the statements of the subject and the observations of the experimenter. While then the original ranking might be used with practically equal justification it seemed altogether desirable to use the judgment of the group as the basis of approximating the true ranking since the advantage of the group judgment over the individual judgment has been shown experimentally.

The question naturally arises, to what extent the reports of

depression and elation are clouded by the influence of anger and irritability at the one extreme or excitability at the other. There are in the verbal reports one instance of being "mad," one of being in a "bad humor" (the subject was evidently quite angry), one of being "cross," one "bored, with a calm acceptance of things." Among the observations made by the experimenter there is one instance of a subject being "irritable." The subjects in the group test when not cheerful reported "fatigue," "headache," "worry." There was one instance of "being cheerful despite headache." In the records for the upper level there was little to aid in differentiating excitability from actual cheerfulness. There were two instances of mixed emotion holding over from the day before when anger was felt because of an injury received. There had been a struggle between the spirit of anger and the virtue of charity and the latter was controlling at the time of the test. This is a small number out of the 413 records taken of mood. The report as a whole then may be considered as indicating levels of cheerfulness ranging from depression to mild elation, with some allowance made for records modified by anger or irritability.

Section 3

Method of Eliminating Practice Effect from the Original Scores

It is obvious that, in a repeated exercise of any of the functions brought into activity by the tests employed in this experiment, the effect of practice would be considerable. Despite the routine previously described which was employed in the Addition Test, the Opposites Test and the Free Association Test, namely of presenting in alternation tests of equal difficulty, thus tending to counteract the effect of practice, the scores showed the characteristic change that is conceded to be due to practice.

It is safe to assume that the effect of practice would not be present in the measures of Mood, Pulse, Blood Pressure, and Line Drawn to Equal in Length a Remembered Standard not seen from the time it was drawn.

For the rest of the tests, the Two Point Threshold Test, Tapping, Muscular Strength, Color Naming, Opposites, Adding and Free Association, the following method was employed for eliminating the effect of practice:

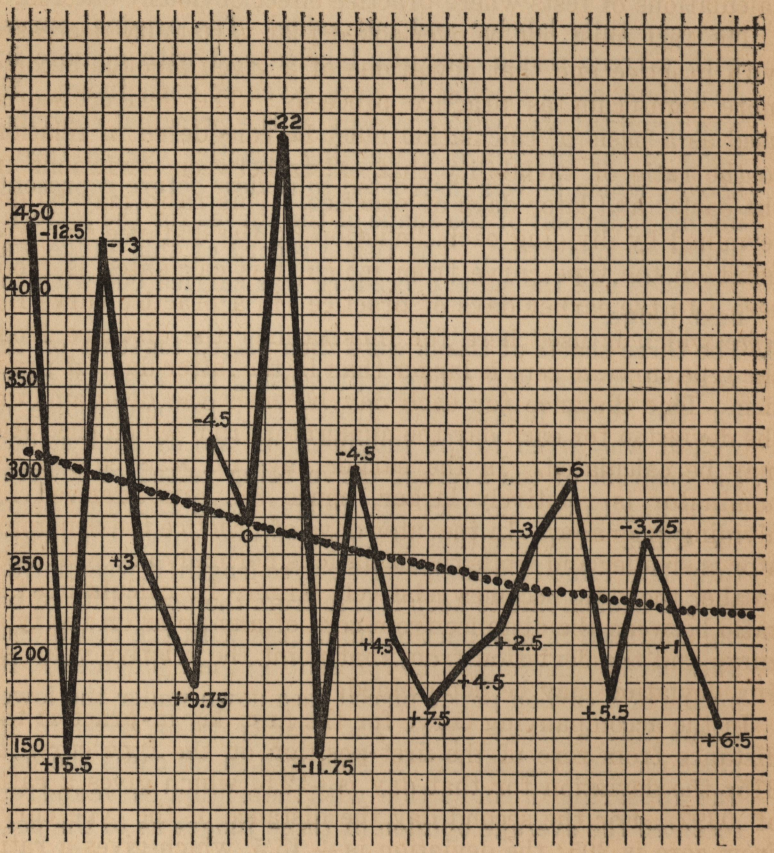
1. The curves for each of the series of test results were plotted on ordinary coordinate paper.
2. Investigation was made by the writer on the effect of practice for the various kinds of material employed. Fortunately for the present study results are available of thoroughgoing experiments covering not only *all* the material used but of experiments covering approximately the same length of time and in some cases a very much longer time. Many of the normal practice curves are to be found in Thorndike, "The Psychology of Learning," Vol. II., Chap. VI and VII. These were copied out and additional curves plotted from the results of Woodworth and Wells, of Poffenberger[21] and of Hollingworth[13] because of the very close correspondence of the present investigation as regards material, method employed and time covered.
3. Using these practice curves as a criterion, the writer drew a practice curve for each series of test results previously plotted. The resulting curve in each case presented the

characteristic features of the normal practice curve, modified to conform to the *individual's* performance in each *individual* series of tests.

4. In order to offset the personal equation of the single judge the judgment of two other people was secured for each curve. One Doctor of Philosophy and two graduate students, assistants in the Psychology Department at Columbia, acted as judges. In order to keep the influence of suggestion out of the results the writer drew in the first curve on a sheet of tissue paper which exactly fitted the coordinate paper on which the test results were plotted. This paper was carefully labeled and put aside. The original curves with a fresh tissue carefully labeled and with definite instructions as to placing it, were given to each judge. He was provided also with the copy of the principal contributions to the literature concerning practice curves (see 2 above) which he was instructed to review before representing his judgment of the shape of the curves for the material under consideration. The tissue record of this judge was put aside and the same procedure was carried out with the next judge.
5. The three sheets of tissue were then placed together on the original curves, and a line representing the average curve for the three judges was drawn in. Preponderance of weight was given to the judgment of two as against one, the position of the average curve being raised or lowered according to the distance two judges stood above or below the third. The position of this average curve thus carefully determined throughout its entire length, it was marked in by a broken line to keep it free from the possibility of being confused in any part of its course with the continuous lines used by the judges in representing their judgments. By means of a carbon paper placed face down under the lower tissue this average curve was readily transferred to its place on the original curve. This was in all cases the only line appearing in connection with the original curve and represented the average opinion of three judges as to the position of the normal practice curve for the individual in the particular test in question. In other words, it represents the position of the scores the individual in question could have been expected to have made, unmodified by other factors. Any deviation from this normal practice curve,

modified to suit the individual performance in any particular test, can reasonably be said to be due to the influence of some other factor and not to practice effect. It is clearly seen that any correlation to be reliable must be made between mood and scores which represent the degree of deviation from the normal practice curve.

6. Accordingly, for each score a derived score was obtained by counting on the original plotting the number of squares above or below the point in the normal practice curve that any individual score lay. See curve that follows.



Curve for Addition
Subject P. Group 11.
1 sq. = 10 Seconds.

Score 1 is 12.5 squares above the normal practice curve, hence is marked .–12.5. Score 2 is 15.5 squares below, hence is marked +15.5. The score for the fifth day is 9.75 squares below, hence is marked 9.75. Score 7 is at the point where it could be expected to be on the seventh day of practice, hence is marked 0. The score the eighth day is 22 squares above, hence is marked –22 and so on. These derived scores, determined in terms of squares, represent the individual's performance, with practice effect eliminated. They were then substituted in every case for the original scores and used as the basis of all calculations of tests where practice effect obviously entered.

The fact must not be overlooked that variability decreases with practice and that deviations of a given amount become more significant as practice proceeds. The derived scores used as a basis of calculation must be considered in relation to the ratio of variability that exists between deviations in the earler and later days of practice. This ratio may be determined by dividing each deviation by the distance that the point on the type curve from which it is calculated is from zero. In the earlier days of practice (in a practice curve for *time* which is used here for illustration) the distance from the type curve to zero is larger than in the latter days of practice. This distance for each day becomes the denominator, the deviation for each day the numerator from which the ratio may be calculated. In the earlier days of practice the denominator is relatively larger, hence the ratio derived by dividing is smaller. In the later days of practice the denominator is smaller and while the deviations normally are relatively smaller the ratio becomes relatively larger. By calculating the ratio between the distance from zero of any point on the type curve and the deviation from that point the relative value of any deviation may be determined.

In the accompanying curve for the first day of practice the distance from zero of the first position on the type curve is 315; the deviation for that day is –12.5, which gives a ratio of .0397. For the second day the distance of the type curve from zero is 305; the deviation is + 15.5, which gives a ratio of .0508. For the third day the distance of the type curve from zero is 300; the deviation is –13 which gives a ratio of .0433. The ratio for each day of practice being calculated the ratios are ranked from the largest minus to the largest plus and

this order should be used to determine the degree of correlation with the rankings for mood.

In this study the absolute and not the relative value of deviations were used in calculating the coefficients of correlation. In order to test the validity of these coefficients the ratio of the deviations were worked out for a number of curves. Care was taken to select cases that might be affected by using relative deviations. These selections included curves which indicated that the effect of practice was considerable; others where the effect was slight and still others where the scores made in the later days of practice were actually inferior to those made in the earlier part of the practice. The ratio of variability for each day of practice was calculated from these curves. The ratios were ranked and correlated with the rankings of the absolute deviations used in this study and in no case did the coefficient of this correlation fall below .98. The coefficients of correlation that appear in Tables I, II, III, XVII, XVIII, XIX of this study are then practically what they would be if calculated from relative deviations.

The following method was used, also, to determine the ratio of deviation at different points on the practice curve. The average deviations were secured for successive groups of five. In order to keep the change gradual the average was found for the first five deviations; then for the second to the sixth inclusive; next for the third to the seventh inclusive, and so on, to the end of the curve. The ratio was then found between successive average deviations and the actual deviations. These ratios were ranked in order from the largest minus to the largest plus. By this method due weight could be given to fluctuations in the later periods of practice. The method is applicable to curves plotted for amount of work done and to curves plotted for time taken to do work. The rankings secured by this method correlated practically perfectly with the rankings of the absolute deviations.

CHAPTER III

DISCUSSION OF RESULTS

SECTION 1

THE RELATION OF MOOD TO PERFORMANCE IN THE VARIOUS TESTS

The object of this research being to observe if degrees in cheerfulness parallel quantity and quality of performance the method of rank difference was determined upon as possibly the best to use, considering the nature and purpose of the experiment. The scores for mood were ranked according to the method described in Chapter III. The derived scores, determined by the method described in the same chapter, were ranked in order from the lowest minus to the highest plus. The relationship between the two rankings was then determined in terms of relative position by the method of rank differences employing the formula,

$$\rho = 1 - \frac{6\Sigma D^2}{n(N^2-1)}$$

The correlation coefficients thus secured, based on rank difference, are almost necessarily used when the variables to be correlated are expressed in ranks. For purposes of ready comparison r, corresponding to ρ, was obtained by use of tables devised for this purpose. The maximum change from ρ to r is .018, a difference that may be disregarded in the present study which is not concerned with fine distinctions but with tendencies.

It should be explained that the test results in every case were arranged so that a positive correlation always means the correlation between good performance and cheerful mood. In measures of speed and amount the scores were arranged from lowest to highest. In the case of accuracy of course the best records were those where fewest errors were made. In the test for Circulation the scores were arranged from lowest to highest. In results for Line Drawn to Equal in Length a Remembered Standard longer lines always mean good performances. Possibly if we knew what was being measured the drawing of shorter lines might be the desirable perform-

ance, in which case the sign of the correlation should be changed. The same is true for the tests of Circulation. This possibility must be borne in mind in interpreting the data for the tests.

The following tables give the 308 coefficients of correlation of mood with performance for the three groups in each of the tests:

TABLE I. GROUP I

	Pulse Rate	Systolic Blood Pressure	Line	Two Point Threshold	Right Hand Grip	Tapping	Color Naming	Errors	Addition	Errors	Individual Reactions Average Reaction Time	
					Women							
L.	.00	-1.00	.21	-.42		.00	-.66	.42	-.82	-.42	.52	.14
K.	.05	-.20	.21	.72	.00	.72	-92	.72	.56	.92	.92	.96
M.	.15	.35	-.62	-.15	.67	.38	.03	-.46	-.64	-.23	.05	-.10
					Men							
C.	-.52	-.52	.52	.15	1.00	.50	.52	-.64	.52	.52	.52	-1.00

TABLE III. GROUP III

	Line	Tapping	Opposites	Errors.	Additions	Errors	Individual Reactions
			Women				
H.	.26	.10	.20	.52	-.15	.52	-.03
L.	-.56	-.48	-.34	.52	-.22	-.05	-.40
McN.	-.28	-.50	.26	-.15	.02	.81	-.10
M.	-.05	.05	.02	.52	-.25	-.17	.06
Ti.	.21	-.36	-.68	.52	-.17	-.01	-.71
Co.	-.15	-.21	-.96	.52	.27	-.28	.35
R.	.90	-.50	-.31	.50	.40	.50	-.74
Ca.	-.33	-.44	.34	.21	.37	-.62	.13
D.	.16	-.81	-.81	.50	-.67	.80	-.57
Ta.	.62	.21	.81	.50	-.16	.00	-.86
O.	-.12	-.21	-.04	.52	.18	.46	.35
			Men				
Ac.	-.23	-.84	.03	.52	.16	.74	.14
Al.	.77	.32	.04	.60	.60	-.12	-.44
Ax.	-.11	.00	.17	.50	-.06	.23	.31
Ga.	.91	.62	-.59	.52	-.62	-.10	-.15
Ka.	.19	-.72	-.83	.52	.08	.10	-.33
Ko.	.52	-.26	.28	.52	-.26	-.25	-.52
Ma.	-.05	.42	.16	.52	.40	.19	.66
Mi.	-.44	.67	.66	-.15	.05	.52	.40
W.	-.38	.82	.20	.52	.91	-.46	-.68
J.	-.35	-.36	.21	.52	.16	-.15	-.44
Gr.	.48	-.88	-.86	.52	.70	.58	-.32
N.	-.31	-.31	.57	.52	.40	-.36	.60

TABLE II—GROUP II

	Pulse Rate	Systolic Blood Pressure	Diastolic Blood Pressure	Pulse Pressure	Line	Two Point Threshold	Right Hand Grip	Left Hand Grip	Tapping	Color Naming	Errors	Addition	Errors	Individual Reactions	Average Reaction Time
Men															
L.	.29	−.27	−.33	.02	−.31	.27	.52	.66	.25	.21	−.27	−.29	.29	.29	.25
S.	−.49	.44	.13	.01	−.72		.37	−.33	.15	−.08	−.15	−.08	.21	−.29	−.34
K.	−.10	.06	−.15	.08	.33	.23	−.13	−.13	−.08	−.15	.13	.54	.15	−.31	−.31
H.	−.02	−.19	−.02	−.17	.24	.46	.13	−.13	.42	.23	.02	−.17	−.42	.20	.29
P.	−.10	.33	.37	−.08	.21	.02	.33	.54	.74	.35	.02	.23	.08	.15	.31
Women															
F.	.17	−.08	.05	.10	.17	.17	−.10	−.70	−.10	−.06	−.37	−.46	.79	−.02	−.17
B.	−.08	−.47	−.61	.48	−.40	−.37	.37	.46	−.51	−.50	.10	−.46	.19	−.33	−.37
O.	−.04	.02	−.04	−.15	−.25	−.15	−.10	−.25	.08	.27	.04	−.08	.35	.31	−.17
T.	−.10	−.04	−.10	.08	−.04		−.33	−.06	.21	−.08	−.13	.27	.01	−.21	−.04
K.	−.02	−.50	.29	−.35	.21	.02	.23	.64	.44	.13	−.35	−.33	−.10	−.08	−.25

Because of the confidence with which the median is accepted as an index of tendencies, it is selected as the basis for further consideration of agreement in results. The median coefficients for the three groups of subjects are given in the table that follows, together with the reliability of each figure, computed by means of the formulae,[27]

$$\sigma \text{dis.} = \sqrt{\frac{\Sigma d^2}{n.}}$$

$$\text{P. E.}_{\text{t. med.} - \text{obt.med.}} = .6745 \left(\frac{5}{4} \frac{\sigma \text{dis.}}{\sqrt{n.}} \right)$$

In all instances the figures for reliability mean that if the experiment were repeated in the same way and under the same conditions what are the chances out of 100 that the median will be equal to or greater than zero. It will be noticed that the reliability is low in a few cases, fair in others, and high in still others, but in *all* cases with one exception the probability is that the obtained median coefficient approximates toward the true median coefficient, especially with respect to its position away from zero.

On examining the results presented in the following tables it is readily seen that they differ widely not only with regard to the performance of the separate individuals but with regard to the individual's own performance in the several tests. For example, for Group I, the coefficients of correlation for mood with pulse vary from .00 to .15 with the median at .05 for the woman. If the results for the one man who took part in this division of the experiment were included, the range would extend from –.50 to .15 with the median at –.02. In Group II the coefficients of correlation for the women range from –.47 to .28 with the median at –.10. For the men of this group the range for pulse is from –.08 to .17 with the median at .04.

For the Two Point Threshold Test, the range for Group I is from –.42 to .72 with the median at –.15. The individual coefficient of correlation for the man of Group I is .13, slightly above the median for the women of this group. The women of Group II range from .02 to .46 with the median at .25; for the men of this group the range extends from –.37 to 17 with

Median Coefficients

	Pulse Rate	Systolic Blood Pressure	Diastolic Blood Pressure	Pulse Pressure	Line	Two Point Threshold	Right Hand Grip	Left Hand Grip	Tapping	Color Naming	Errors	Addition	Errors	Individual Reactions	Average Reaction Time
						Women									
Group I	.05	-.20	—	—	.21	-.15	.33	—	.00	.03	.42	-.64	-.23	.52	.14
Group II	-.10	.06	-.02	.01	.21	.25	.13	-.13	.25	.21	.02	.08	.15	.15	.25
Group III	—	—	—	—	-.05	—	—	—	-.36	-.04	.50	-.15	.00	-.10	—
Combined	-.01	-.05	-.02	.01	.21	.23	.13	-.13	-.08	.02	.50	-.15	.08	.05	.195
Average	-.02	.06	.00	.03	.20	.18	.31	.12	-.07	.03	.27	-.05	.13	-.05	.14
S. D.	.21	.03	.44	.087	.40	.23	.35	.39	.41	.48	.33	.38	.42	.45	.39
P. E. of Med.	.06	.0084	.1686	.033	.0786	.0745	1.2	.92	.99	.21	7.00	2.1	.97	.58	1.5
Med./P. E.	.16	5.5	.11	.33	2.7	3.1	.1058	.1494	.0803	.0941	.0659	.0745	.0821	.0859	.1263
Reliability	47.33	100.	47.31	58.02	96.57	58.17	79.58	27.09	27.09	55.36	100.	7.83	72.91	63.21	84.41
						Men									
Group I	One	Subject	only.												
Group II	.04	-.08	-.04	.08	-.04	-.065	-.10	-.06	-.08	-.06	-.13	-.33	.19	-.08	-.17
Group III	—	—	—	—	-.08	—	—	—	-.13	.165	.52	.16	.00	-.235	—
Combined	-.04	-.08	-.04	.08	-.04	-.065	-.10	-.06	.00	.13	.52	.08	.10	-.15	-.17
Average	-.01	-.21	.08	.05	-.04	-.08	-.02	.02	-.03	-.01	.28	.09	.12	-.06	.20
S. D.	.30	.22	.29	.26	.40	.20	.25	.48	.52	.45	.33	.41	.35	.39	.10
P. E. of Med.	.0145	.0843	.1116	.0996	.0824	.0843	.067	.1839	.1069	.0923	.0678	.0842	.0719	.0802	.0383
Med./P. E.	2.7	.94	.71	.82	.60	.71	1.5	.31	.28	1.4	7.6	.94	1.3	1.8	4.4
Reliability	3.42	27.09	31.84	70.53	34.21	31.84	15.59	41.89	50.00	82.75	100.00	72.91	80.97	12.04	00.15
Men and Women															
Combined	-.02	-.08	-.03	.015	.045	.02	.065	-.095	-.05	.035	.50	.06	.09	-.055	-.10
Average	-.01	-.12	-.04	.01	.02	.07	.10	.13	-.05	-.02	.28	.02	.13	-.06	.01
S. D.	.157	.37	.28	.19	.39	.32	.27	.37	.60	.47	.23	.40	.41	.42	.36
P. E. of Med.	.0301	.0866	.0762	.0516	.0565	.0817	.066	.1006	.0843	.066	.0309	.0593	.0617	.095	.0843
Med./P. E.	.63	.92	.52	.29	.83	.24	1.5	1.06	.59	.52	13.00	1.01	1.5	.93	1.1
Reliability	34.29	27.09	36.79	58.02	70.53	55.36	84.41	25.00	36.79	63.21	100.00	75.00	84.41	27.09	32.91

the median at –.065. In the cases of one man and one woman of the group it was impossible at any time to obtain a reliable record of ability to discriminate the two points of the aesthesiometer. Their responses to stimulation were strangely wide of the truth and appear to be unaffected by any increase or decrease in distance between the two points simultaneously stimulated. Stimulation of points varying in distance from 2 cm. to 7cm. apart on the back of the hand, palm of the hand, forearm, tips of fingers, lips or forehead failed to result in any more accurate responses. The responses varied from 3 cm., 4 cm., to 38 cm. for simultaneous stimulation of two points. Indeed, the same responses seemed to follow with equal variety if only one point was stimulated. The inability to discriminate the two points seemed to bear no relation to mood or ability to react with varying degrees of accuracy to the other tests given from day to day.

The results for tapping show a range in coefficients for the women of Group I from –.38 to .72 with the median at .00. The correlation coefficient for the men of this group is .50. The women of Group II vary from –.08 to .74 with the median at .25. The men of Group II vary from –.57 to .44 with the median at .08. The coefficients for the women of Group III range from –.81 to .05 with the median at –.36, for the men of Group III from –.84 to .00 with the median at –.13. Correlation coefficients indicating as wide a range appear in the results for the Addition Test, for the Color Naming Test; for Free Association, for Tests of Muscular Strength and the Line Drawn to Equal in Length a Remembered Standard.

A few high correlations appear in the results. For example, in the case of K., Group I, correlation of mood with tapping and color naming give coefficients of .70 and .90 respectively. Subject S., in Group III, shows a coefficient of –.70 and .90 respectively. Subject S., in Group III, shows a coefficient of –.72 for the correlation of mood with Line Drawn to Equal in Length a Remembered Standard. The coefficient for Subject K., Group II, in the Addition Test, is .54; for Subject P. in the same group, the coefficient for the tapping test is .74.

In the results for Strength of Grip the comparatively high coefficient of –.70 in the case of Subject F. and .64 in the case of Subject K. for left hand grip are in interesting contrast to –.10 and .22, respectively, for the right hand grip. Noticeable in the results for Group III is the coefficient of .82 in the Tap-

ping Test in the case of Subject W; of –.72 in the same test for Subject Ka; of –.88 for Subject G. Other instances are easily apparent on inspection.

Any single high correlation does not mean a great deal considering the period of time covered by the experiment. It is obviously a difficult matter to find people who can spare time regularly and for any extended period to take part in an experiment of this nature. This experiment with Groups I and III had the advantage of having subjects who worked at the regular recitation periods. It had the disadvantage of being interrupted in each case by the spring vacation and of being terminated automatically by the closing of the college term. With the subjects of Group II it seemed advisable to limit the testing to six weeks in order not to impose unduly upon the courtesy of the hospital, and on the time of the medical staff, nurses and attendants, and above all, on the patience of the subjects themselves.

The Probable Error of the various coefficients presented in the above tables is large, yet the results are not entirely without significance when it is remembered that they represent calculations from the scores made by a variety of subjects, both men and women, under controlled conditions as to place of giving the tests, method adhered to, and material used.

The method used for measuring mood has certain obvious weaknesses but in view of the test made of it by the method detailed in Chapter II, in the opinion of the writer it can be accepted as a rough measure of mood, especially in a study that is primarily concerned with relative positions indicative of tendencies and not with fine distinctions.

Considering the test results as a whole, for the women, out of 160 correlation coefficients between mood and performance, 88 or 55 per cent are positive, 70 or 44 per cent are negative, while 2 or 1 per cent are zero. For the men, out of 148 correlation coefficients, 79 or 53 per cent are positive and 69 or 47 per cent are negative. For the group as a whole, out of 308 correlation coefficients, 167 or 54 per cent are positive, 139 or 45 per cent are negative, and 2 or less than 1 per cent are zero.

The last ten tests are more definitely tests of performance than are the first five tests (for Circulation and Drawing of a Line to Equal in Length a Remembered Standard). The 248 coefficients of correlation for these ten tests were plotted in the form of a distribution curve. Table IV gives the results

of this distribution—the 25 percentile, the 75 percentile, the median, the P. E. of the median, Q and the range. Table V shows the correspondence of the actual distribution to the normal distribution. The correspondence is fairly close between the actual and the normal distribution for the sexes considered separately or combined. There is no clear departure from zero correlation which is here assumed to be the norm and consequently little to indicate the influence of mood.

TABLE IV

	25 Percentile	Median	P. E. of Median	75 Percentile	Q	Range	No. of Coefficients
Women	−.28	+.046	±.03	+.268	.274	−.96 to +.96	130
Men	−.312	+.022	±.036	+.316	.314	−100 to +1.00	118
Men and Women Combined	−.3	+.036	±.0026	+.3	.3	−1.00 to +1.00	248

TABLE V

	−4Q	−3Q	−2Q	−1Q	+1Q	+2Q	+3Q	+4Q
Normal Distribution	.012	.067	.16	.50	.16	.067	.012	
Women		.065	.187	.50	.163	.083		
Men	.005	.072	.172	.50	.157	.088		
Men and Women Combined	.0081	.081	.1613	.50	.137	.081	.024	

TABLE VI

	25 Percentile	Median	P. E. of Median	75 Percentile	Q	Range	No. of Coefficients
Tapping	−.395	+.0375	±.08	+.387	.389	−.88 to +.82	37
Controlled Association	−.337	+.087	±.068	+.371	.354	−1.00 to +.92	37
Addition	−.243	+.16	±.063	+.374	.308	−.82 to +.91	37
Errors in Addition	−.168	+.112	±.07	+.514	.341	−.67 to +.92	37
Individual Reactions	−.393	—.05	±.07	+.318	.3555	−.74 to +.92	37

TABLE VII

	−4Q	−3Q	−2Q	−1Q	+1Q	+2Q	+3Q
Normal Distribution	.012	.067	.16	.50	.16	.067	.012
Tapping		.081	.162	.513	.216	.027	
Controlled Association		.108	.135	.648	.081	.027	
Addition		.108	.135	.518	.216	.027	
Errors in Addition		.027	.243	.486	.216	.027	
Individual Reactions		.027	.216	.54	.189	.027	

Table VI shows the results of a similar distribution of the 37 coefficients of correlation for each of the five tests in which all of the 37 subjects took part. Table VII shows the correspondence between the actual and the normal distribution. Table VI shows the range to be practically the same for all tests. The 25 percentile and the 75 percentile are also about the same for Tapping, Controlled Association and Individual Reactions. In the Addition Test, both for time and errors, the measures tend to fall toward the positive side of zero but still not far from zero.

Compared with the normal distribution, the actual distribution shows that the measures are slightly more numerous toward the center in the Controlled Association Test and in the test for Individual Reactions, and tend also to be in excess of the normal distribution between +2Q and +1Q in Tapping, Addition, Errors in Addition and Individual Reactions. The distance, —1Q and —2Q shows an excess of measures for Errors in Addition and Individual Reactions. In no case, however, is the departure from the normal distribution sufficiently marked to conclude that mood had influenced results. Taking the individual separately in these ten tests of performance, there are but two whose r is always either plus or minus and 12 who are consistently plus or minus from 80 to 100 per cent of the time; so there is little to indicate individual differences.

The question arises to what extent the low correlation coefficients are due to inferior performance in the lower and upper levels of cheerfulness, the middle levels of cheerfulness, perhaps, being favorable to better performance. If such were the case the coefficients of correlation would be low yet there would actually be correspondence between mood and performance. To test this the rankings for mood and for each of the tests for all the subjects were divided into four levels and the median rank determined for each level. There were a

few instances of direct positive relationship between levels of mood and levels of performance as observed from the median rank for each level. A few direct negative relationships were also observed. In every instance this same relationship was shown in either a positive or a negative coefficient as a result of correlating the actual rankings. There was no individual whose performance was consistently best or worst at any one level. The middle levels of mood did not show that performance at these levels tended to be superior to that in the higher or lower levels of mood. In fact the relations observable in this arrangement of the data would indicate a low degree of correlation between mood and performance.

CHAPTER III

SECTION 2

Combination of Tests to Secure a Measure Freer from Attenuation

The original purpose in working out the correlations was to analyze out some of the factors which enter into mood and to do this a rather wide variety of tests were used and the results correlated with the mood taken at the time of performance. It seems quite possible in correlating the results of the tests separately with mood which at best must be rather a rough measure, that any relation present would tend to be minimized and result in a low coefficient.

Accordingly the results of several tests obviously measuring common elements were combined in an effort to get a measure freer from attenuation due to chance errors which do not balance out in the case of correlation but cause the coefficient to approximate zero. The following tests were combined because of the obvious common element:

1. For Muscular Strength.....Right and Left Hand Grip
2. For Speed—Color Naming (time) and Tapping.
3. For Speed—Color Naming, Adding (time) and Average Reaction Time in the Free Association Test.
4. For Accuracy—Color Naming, Adding and Individual Reaction, errors taken in all three cases.

In each of the four combinations the rank orders as determined for the derived scores were summed. The composite measure thus obtained was ranked and as was the case with the individual tests correlated with the rankings for mood by the Method of Rank Difference. Tables IX and X show the corrected coefficients and also the coefficient for the individual tests combined to secure the composite measure.

Three tendencies are apparent in the corrected coefficients:

1. A tendency for the positive coefficients to increase in the positive direction.

2. A tendency for the negative coefficients to increase in the negative direction.

TABLE IX

CORRELATION COEFFICIENTS FOR COMPOSITE MEASURES

		Muscular Strength Right and Left Hand Grip		Speed Color Naming and Tapping		Speed Color Naming Addition Average Reac. Time		Accuracy Color Naming Addition Individ. Reactions	
					.70		.90		.70
Group I Women	K.			.97		.75		.80	
					.90		.55		.90
	M.			−.14	−.37	−.41	.03	.00	−.45
					.03		−.63		−.22
	L.			−.50	.00	−.80	−.65	−.20	.40
					−.65		−.80		−.40
							.21		−.27
Group II Women	L.	.68	.50	.15	.21	−.04	−.29	−.23	.21
			.64		.25		.25		.29
	S.	−.54	−.37	.06	−.08	−.21	−.08	−.25	−.15
			−.33		.15		−.08		.21
							−.34		−.29
			−.12		−.14		−.14		.12
	K.	−.14	−.12	−.20	−.08	.08	.52	−.04	.14
							−.30		−.30
			.12		.22		.22		.02
	H.	.00	−.12	.44	.40	.15	−.16	−.17	−.42
							.28		.20
			.33		.35		.35		.02
	P.	.56	.34	.52	.74	.40	.23	.28	.08
							.31		.15
			−.10		−.06		−.06		−.36
Group II Men	F.	−.54	−.68	−.20	−.10	−.34	−.44	.16	.78
							−.17		−.02
			.36		−.48		−.48		.10
	B.	.42	.44	−.64	−.49	−.66	−.44	.18	.18
							−.37		−.33
			−.10		.27		.27		.04
	O.	−.19	−.24	.24	.08	−.19	−.08	.29	.35
							−.17		.31
			−.33		−.08		−.08		−.13
	T.	−.31	−.06	.06	.21	.00	.27	−.06	.01
							−.04		−.21
			.23		.13		−.13		−.35
	Km.	.44	.64	.42	.44	−.34	−.33	−.42	−.10
							−.25		−.08

TABLE X

CORRELATION COEFFICIENTS FOR COMPOSITE MEASURES

Group III	Speed Tapping Opposites Addition	Accuracy Opposites Addition Individual Reactions	Group III	Speed Tapping Opposites Addition	Accuracy Opposites Addition Individual Reactions
	Women			Men	
H.	.28	.10 .19 −.14 −.03 .50 .50 −.03	Al.	.48	.04 .60 −.82 −.40 .11 −.44 .52
L.	−.75	−.46 −.33 −.21 −.33 .50 −.05 −.38	Ac.	−.30	.03 .16 .00 .43 .74 .14 .50
Mc.	−.21	−.48 .25 .02 .00 −.14 .80 −.10	Ax.	.07	.17 −.06 .60 .38 .23 .31 .50
M.	−.08	.03 .02 −.24 −.15 −.17 −.17 .06	Ga.	−.26	−.57 −.60 −.87 −.30 −.19 −.14 .68
O.	−.25	−.20 −.04 .17 −.37 .44 .44 .34	Gr.	−.59	−.85 .68 −.35 −.04 .56 −.31 .50
Ti.	−.69	−.35 −.66 .16 −.61 .50 −.01 −.69	J.	.30	.20 .15 −.70 −.57 −.14 −.42 .50
Co.	−.39	.20 −.95 .26 .44 .50 −.27 −.34	Ku.	−.59	−.82 .08 −.26 −.10 .10 −.32 .50
R.	−.35	.48 −.30 .38 −.52 .50 .44 −.72	Ko.	−.04	.28 −.26 .67 −.71 −.24 −.50 −.14
Ca.	.33	−.42 .33 .36 −.49 .20 −.62 .12	Mi.	.73	.66 .05 −.31 .15 .50 .38 .52
D.	−.67	−.80 −.80 −.65 −.57 .50 −.65 −.65	Ni.	.19	.57 .40 .40 .08 −.36 .60 .50
Ta.	.21	.20 .80 −.15 .36 .50 .00 −.85	Ma.	.77	.15 .38 .82 .69 .18 .64 .50
			W.	.54	.20 .91 −.64 −.44 −.66

3. A tendency for both positive and negative coefficients to take a position somewhat between the raw coefficients or even beyond either extreme, whether the raw coefficients were all positive, all negative or both positive and negative.

To bring together this loosely connected group of correlations in any sort of consistent scheme is almost impossible but it can certainly be said that taking account of attenuation by the method used here has in a number of cases increased the correlation coefficient by extending it in either a positive or negative direction. In other cases it resulted in bringing the coefficient to somewhat of an intermediate position. In a

TABLES XI

EXAMPLES OF THE FIRST TENDENCY

Tests Combined	Subject	Group	Raw	Coefficients		Corrected Coefficients
Rt. Lt. Hand	L	II	.50		.64	.68
Rt. Lt. Hand	P	II	.33		.54	.54
Color Naming and Tapping	H	II	.22		.40	.44
Color Naming and Tapping	K	I	.70		.90	.97
Color Naming, Adding & Ind. R.	P	II	.35	.23	.31	.40
Tapping, Opposites and Adding	Mi	III	.67	.66	.05	.73
Tapping, Opposites and Adding	Ma	III	.40	.15	.38	.77

TABLE XII

EXAMPLES OF THE SECOND TENDENCY

Tests Combined	Subject	Group	Raw	Coefficients		Correct Coefficients
Rt. & Lt. Hand Grip	S	II	−.37	−.33		−.54
Color Naming and Tapping	F	II	−.06	−.10		−.20
Color Naming and Tapping	B	II	−.48	−.49		−.64
Color Naming, Adding, & Ind. Reactions (Errors)	Km	II	−.35	−.10	−.10	−.42
Opposites, Adding & Indiv. Reaction	L	III	−.40	−.33	−.21	−.75
Color Naming Adding Avg. Reaction Time	B	II	−.48	−.44	−.37	−.66
Tapping, Adding Indiv. Reaction	T	III	−.35	−.66	−.16	−.69

TABLE XIII
EXAMPLES OF THE THIRD TENDENCY

Tests Combined	Subject	Group	Raw	Coefficients	Corrected Coefficients
Color Naming and Tapping	L.	II	.21	.25	.15
Color Naming and Tapping	O.	II	.27	.08	.24
Tap. Add'g and Opposites	Al.	III	.32	.04 .60	.48
Tapping and Opposites (Time)	W.	III	.82	.20 .91	.54
Opposites, Add'n, Ind. Reactions	Ak.	III	.52	.74 .14	.43
Rt. & Lt. Hand Grip	F	II	–.10	–.68	–.54
Tapping, Opposites, Adding	Mc'l	III	–.80	–.80 –.65	–.67
Color Naming and Adding, Avg. Reaction Time	F	II	–.06	–.44 –.17	–.34
Opposites, Adding, Indiv. React.	J.	III	.50	–.14 –.42	–.57
Opposites, Adding, Indiv. React.	G.	III	.50	–.14 –.10	–.30
Opposites, Adding, Indiv. React.	J.	III	.50	–.14 –.42	–.57
Tapping, Opposites, Adding	H.	III	.19	.10 –.14	.28
Tapping, Opposites, Adding	O.	III	–.25	–.20 .17	–.25
Tapping, Opposites, Adding	J.	III	–.35	.20 .15	.30

few other cases when positive and negative results were combined, the corrected coefficient took a position either beyond the largest positive or beyond the largest negative. In all probability, the three tendencies indicate that the employment of the composite measure as one of the variables in the correlation has had the effect of balancing out chance errors.

To be consistent with the procedure so far held to in the discussion of results, that is of considering median coefficients, any general effect of combining tests must be observed by comparing medians.

A glance at the medians in Table XIV and those presented here show that correction does not affect the median coefficients very much. For Strength of Grip the correction for the women gives .00, midway between .13 and –.13 for the right and left hand. For the men it is –.19 increasing the tendency in the negative direction from –.10 and –.06 for the

right and left hand. For the results as a whole, –.07 is in the direction of an intermediate position between .065 and –.095. For the women of Group I and Group II the median for the composite measure for Color Naming and Tapping, .21 .25, respectively, is .10. When the results for Group III (the Opposites Test and Tapping) are included the median coefficient is increased on the negative side. The tendency for the composite measure in both groupings is in the direction of a negative correlation. For the men of Group II in the same tests an intermediate position is maintained .06, between –.06 and .08. When the results for Group III are added the correlation is still more positive, .07 consistent with the tendency indicated by the raw median coefficients .13 and .00. For the men and women combined, excluding Group III the median coefficient is .06. Including Group III it is –.06 in either case somewhat beyond the extremes for the raw coefficients .035 .05.

TABLE XIV

MEDIAN COEFFICIENTS FOR COMPOSITE MEASURES

	Muscular Strength Right and Left Hand Grip	Speed Color Naming and Tapping	Speed Color Naming Addition Av. Reaction Time	Accuracy Color Naming Addition Indiv. Reactions
Women, Groups I & II	.00	.10	.02	.17
Men, Groups I & II	–.19	.06	–.34	–.04
Combined	–.07	.06	–.19	–.08

For Group III the rankings in the Tapping Test, the Opposites Test and the Addition Test were combined to secure a composite measure for speed. The rankings of errors in the Opposites Test, and in Addition were combined with the rankings in the Individual Reactions to secure a composite measure for Accuracy. When the correlation coefficients for this measure of speed are included with the two measures for speed for Groups I and II the medians are as follows:

TABLE XV

	Muscular Strength Right Hand Left Hand Grip	Speed Color Naming and Tapping	Speed Color Naming Add'n. Avg. React. Time	Accuracy Color Nam'g Add'n. Ind. Reaction
Women	.00	–.14	–.21	.17
Men	–.19	–.07	–.04	–.10
Combined	–.07	–.06	–.135	–.08

For the composite measure for speed (Color Naming (.02), Addition Test (.–15) and Average Reaction Time in the Free Association Test (–.195) the median coefficient for the women is .02, exclusive of Group III. Inclusive of Group III it is –.21 intensified in the negative direction due to the additional negative coefficient –.04 for the Opposite Test.

For the men of Group I and II the composite measures give for the same tests a median coefficient of –.34. Including Group III the median is –.04, the raw coefficients being respectively .13, .08 and –.15.

For the composite measure for accuracy (Errors in the Color Naming and Addition Test and Individual Reactions), the median coefficient is slightly lower for the women, .17 instead of .195; for the men it is considerably lower, –.04 instead of –.17; for the results as a whole –.08 instead of –.10, but still consistent with the medians for the raw coefficients.

A further attempt to take account of attenuation was made by adding the original ranking for Pulse and Systolic Blood Pressure and using the sum as a composite measure that might correlate better with mood than did either of the measures taken singly. The same general tendency noticed in the results for the composite measure in the tests of performance appears here. In Group I two corrected coefficients are increased in a negative direction; another is increased in a positive direction with the median at –.32 instead of .05 and –.20, respectively, for the raw median coefficients for Pulse and Blood Pressure. In the case of one man and one woman of Group II, a positive coefficient for Pulse and a negative coefficient for Systolic blood pressure give a low negative corrected coefficient –.02 in each case. In three cases a negative coefficient for Pulse and a positive coefficient for Systolic Blood Pressure result in a positive corrected coefficient; in two cases the corrected coefficient falls between the two raw coefficients and in one at the positive extreme. In two cases when the coefficients for Pulse and Systolic Blood Pressure were negative the corrected coefficient is increased in the negative direction beyond the position of the largest negative. Out of eight cases of negative coefficients for Pulse, four remained negative and four became position: In five out of six cases of negative coefficients for Systolic Blood Pressure the corrected coefficient remained negative. In three out of four cases of positive coefficients for Systolic Blood Pressure the

corrected coefficient remained positive. As was the case with the composite measures used in the tests of performance, the median coefficients here are but slightly affected, being –.03 for the women and –.02 for the men with –.02 for the men and women taken as a group. For the women the corrected median coefficient falls between –.01 and –.05 for Pulse and Blood Pressure respectively; for the men it is nearer zero than either raw coefficients –.04 and .08; for the results combined it falls within the limits of the raw coefficients, –.02 and –.08.

Still another attempt to secure a measure that might be freer from attenuation was made by combining the scores for Pulse and Pulse Pressure. The results appear in Table XII.

TABLE XVI

MEDIANS FOR COMPOSITE MEASURES OF CIRCULATION

	Pulse and Systolic Blood Pressure	Pulse and Pulse Pressure
Group I —Women	–.32	
Group II—Women	–.02	–.06
Combined	–.03	
Group I —Men		
Group II—Men	–.02	–.14
Men and Women Combined	–.02	–.10

For the women four cases of negative coefficient for Pulse remain negative in the combined measure; for the men three out of four remain negative. In the case of one woman the position coefficients for both Pulse and Pulse Pressure remain positive, falling between the position of each. In the case of one man showing a negative coefficient for Pulse and a position coefficient for Pulse Pressure, as a result of combining tests, the coefficient is positive and intermediate between the two.

In another case two positive coefficients a low negative, –.02 appears as the result of combination. As regards Pulse Pressure, for the women, two negative coefficients remain negative, two positive become negative, one positive remains positive. For the men two negative coefficients remain negative, two positive become negative, and one positive remains positive but lower than either of the raw coefficients. For the women the median coefficient for combining Pulse and Pulse Pressure is –.06 as against –.02 for combining Pulse and

Systolic Blood Pressure. For the men it is –.14 somewhat lower than the median –.02 which resulted from combining Pulse and Systolic Blood Pressure.

Although this method of combining tests has had so slight an affect upon the median coefficient, both in the tests of circulation and of performance, the method has served a useful purpose in that it has furnished a sort of check upon the reliability of the work.

CHAPTER IV

SECTION I

CIRCULATION AND PERFORMANCE

It seemed advisable to extend this study into an inquiry of the relation between circulation and mental and physical performance. To that end the scores for Pulse, Systolic Blood Pressure and Pulse Pressure were ranked and each correlated with performance in the several tests in the same manner as with the scores for Mood. This observation is confined to the results for Group I and Group II, the test for circulation having been omitted with Group III because of the impracticability of obtaining such measures under conditions required for group tests. The coefficient for these separate correlations with the measure of their reliability appear in the following three tables.

In all instances the figures for reliability mean that if the experiment were repeated in the same way and under the same conditions what are the chances out of 100 that the median will be equal to or greater than zero.

TABLE XVII

Pulse Rate

	Subjects	Line	Two Point Threshold	Right Hand Grip	Left Hand Grip	Tapping	Color Naming	Errors	Addition	Errors	Individual Reactions	Average Reaction Time
					Women							
Group I	L.	.82	-.72	—	—	1.00	.66	-.21	-.62	-.80	.21	.36
	K.	-.66	.21	.37	—	-.10	-.16	.21	-.36	-.10	.27	.15
	M.	.10	.77	.51	—	.51	.62	-.19	-.35	.33	.51	.38
Group II	L.	-.58	.46	.27	.21	.27	.35	-.42	-.06	.08	-.02	.44
	S.	.56	—	.27	.21	.21	.19	.02	.25	.08	.06	-.02
	K.	.44	.31	-.25	.25	.02	.17	.08	-.15	-.04	-.25	.13
	H.	-.23	-.25	.44	.21	.23	-.37	-.35	.10	.10	-.27	-.33
	P	-.02	.02	.08	-.02	-.19	-.17	-.08	.02	.25	-.48	-.54
Medians Groups combined		.04	.21	.27	.21	.22	.18	-.135	-.10	.08	.02	.14
Average		.05	.11	.24	.08	.37	.16	-.12	-.14	-.01	.00	.07
S. D.		.50	.46	.24	.17	.37	.35	.20	.27	.32	.31	.32
P. E. of Med.	±	.0151	.1492	.0778	.0652	.1293	.1054	.0602	.0813	.0964	.0726	.1227
Med./P. E.		2.66	1.4	3.2	3.2	2.8	1.7	2.2	1.2	.83	.27	1.14
Reliability		96.02	82.75	98.45	98.45	96.48	87.42	6.89	20.92	72.22	57.37	77.09
					Men							
Group I	C.	-1.00	.27	.52	—	-1.00	-1.00	.14	.52	1.00	1.00	.52
Group II	F.	.21	-.23	-.08	.15	-.19	-.25	.25	.27	.19	-.25	.06
	B.	-.13	-.04	-.17	-.17	.17	.17	-.08	-.13	-.33	.21	-.02
	O.	.17	-.13	-.08	.00	-.19	.33	-.29	.33	.06	-.27	-.06
	T.	.08	—	.21	-.46	-.25	.37	.25	.33	.13	.08	.17
	Km.	.13	.02	.17	.23	-.33	.19	-.42	-.13	.04	-.48	-.06
Medians Group II		.13	-.085	-.08	.00	-.19	.19	-.08	.27	.06	-.25	-.02
Average		.09	.08	.01	.05	.14	.16	-.06	.13	.02	.14	.02
S. D.		.11	.17	.15	.27	.33	.22	.27	.22	.18	.38	.17
P. E. of Med.	±	.0421	.0651	.0575	.1035	.1267	.0843	.1035	.0843	.1073	.1457	.0652
Med./P. E.		3.1	1.3	1.4	.00	1.5	2.13	.77	3.4	.57	.17	.306
Reliability		98.17	19.03	17.25	50.00	15.59	92.17	29.18	98.91	64.97	23.52	41.98
Medians Men and Women Combined		.10	.02	.19	.075	.02	.19	-.08	-.06	.08	-.02	.06
Average		.07	.03	.29	.02	.10	.15	.10	-.04	.00	.05	.05
S. D.		.39	.36	.27	.02	.35	.29	.30	.28	.28	.29	.26
P. E. of Med.	±	.0908	.0863	.0669	.0054	.0819	.0619	.0703	.0656	.0566	.0679	.0539
Med./P. E.		1.1	.24	4.00	1.4	.24	2.89	1.12	.91	1.2	.29	1.1
Reliability		77.09	54.04	99.65	82.75	56.43	97.05	22.91	27.42	75.42	42.48	77.09

TABLE XVIII

Systolic Blood Pressure

	Subjects		Line	Two Point Threshold	Right Hand Grip	Left Hand Grip	Tapping	Color Naming	Errors	Addition	Errors	Individual Reactions	Average Reaction Time
						Women							
Group I	L.		-.62	.82	—	—	1.00	.76	-.42	.82	-.42	.42	.66
	K.		.21	-.10	-.82	—	-.31	.10	-.14	.77	-.10	-.21	-.26
	M.		-.28	-.10	.05	—	-.42	.30	.08	.27	-.50	.77	.57
Group II	L.		.68	-.37	-.37	-.15	-.06	-.13	.40	-.33	.37	.02	-.60
	S.		.46	—	-.64	-.06	-.25	-.25	-.46	-.13	.00	-.21	-.33
	K.		.23	.00	-.10	.19	.13	-.10	-.42	-.08	.23	-.21	.29
	H.		-.08	.00	.31	.35	-.27	.02	.10	.21	.15	-.02	.31
	P.		.44	.33	.35	.33	.40	-.02	.15	-.06	.17	.06	.08
Medians Group combined			.22	-.10	-.10	-.06	-.19	.00	-.03	.057	.057	.00	.185
Average			.13	-.15	-.17	.06	-.01	.09	-.09	.18	-.13	.08	.09
S. D.			.40	.33	.42	.24	.44	.30	.30	.39	.30	.33	.42
P. E. of Med.		±	.1533	.1070	.1362	.0919	.1325	.0902	.0902	.1175	.1180	.0994	.1265
Med./P. E.			1.4	.93	.73	.65	1.43	.00	.33	.65	.65	.00	1.45
Reliability			82.75	26.39	31.13	66.85	83.27	50.00	41.20	66.95	66.95	50.00	83.60
						Men							
Group I	C.		-1.00	.65	-.27	—	-1.00	-1.00	.14	.52	1.00	1.00	.52
Group II	F.		.21	.00	.08	.33	.27	-.42	-.06	.15	-.17	-.21	.37
	B.		.13	.21	.42	-.13	.37	.31	-.21	-.27	-.58	.37	.35
	O.		.13	.06	.29	.06	.21	-.54	-.06	-.04	.17	-.06	.27
	T.		-.15	—	.00	.50	.17	.02	.50	.04	-.25	.31	.31
	Km.		-.25	.33	.79	.64	-.15	.04	-.56	.25	.31	.06	-.23
Medians Group II			.13	.135	.08	.33	.21	.02	-.06	.04	-.17	.06	-.31
Average			.01	.15	.15	.18	.17	-.12	-.10	.03	-.10	.10	.21
S. D.			.32	.13	.42	.27	.20	.31	.28	:15	.32	.49	.23
P. E. of Med.		±	.1226	.0548	.1609	.1039	.0655	.1188	.1073	.0574	.1226	.1878	.0881
Med./P. E.			1.06	2.48	.49	3.17	3.2	.16	.56	.15	1.37	.32	3.5
Reliability			78.30	95.00	62.97	99.37	98.45	54.29	35.28	68.16	16.87	58.54	99.12
Medians Men and Women Combined			.13	.00	.03	.195	-.06	.02	-.06	.04	.00	.02	.295
Average			.08	-.02	-.04	.17	.06	.01	-.08	.12	-.05	.08	.14
S. D.			.33	.31	.44	.27	.28	.33	.31	.34	.30	.25	.37
P. E. of Med.		±	.0774	.0772	.1091	.0734	.0659	.0745	.0239	.0726	.0703	.0586	.0867
Med./P. E.			1.68	.00	.27	2.7	27.96	56.96	8.25	64.80	50.00	59.06	98.70
Reliability			87.15	50.00	57.23	96.57	.91	.26	2.08	.55	.00	.34	3.3

TABLE XIX
Pulse Pressure

	Subjects		Line	Two Point Threshold	Right Hand Grip	Left Hand Grip	Tapping	Color Naming	Errors	Addition	Errors	Individual Reactions	Average Reaction Time
							Women						
Group II	L.		.31	-.02	.02	.23	.23	.21	.27	.02	.25	-.15	-.27
	S.		.06		.06	-.29	-.23	.00	-.21	-.08	-.06	.08	.00
	K.		.17	.35	-.08	.27	-.04	.04	.04	-.15	.23	-.27	-.42
	H.		.27	.00	.10	.19	.04	.10	.42	.42	.19	.31	.08
	P.		.42	.25	.08	.21	.23	.08	.23	.02	.37	.31	.29
Medians			.27	.125	.06	.21	.04	.08	.23	.02	.23	.00	-.08
Average			.25	.15	.03	.08	.05	.09	.25	.05	.20	.04	-.08
S. D.			.32	.16	.06	.21	.17	.49	.22	.19	.14	.24	.25
P. E. of Med.		±	.1215	.1096	.0229	.0805	.0633	.0187	.1071	.0728	.0537	.0919	.0958
Med./P. E.			2.22	1.14	2.6	2.6	.63	4.2	2.14	.27	4.28	.00	.83
Reliability			93.28	78.90	96.02	96.02	66.43	99.77	91.23	55.54	99.77	50.00	28.78
							Men						
Group II	F.		.37	-.23	.04	.19	.10	-.52	.08	.33	-.13	-.04	.10
	B.		-.17	-.19	.31	.15	-.04	-.33	-.08	-.46	-.23	-.23	-.44
	O.		-.19	.25	-.06	.19	.33	-.58	.06	-.15	.06	-.44	.54
	T.		-.21		.19	.72	.40	.02	.23	-.02	.00	.25	.06
	Km.		.00	.29	.56	.35	-.21	.17	.37	.48	.10	.27	.06
Medians			-.17	.03	.19	.19	.10	-.33	.08	-.02	.00	-.04	.06
Average			-.04	.03	.21	.32	.11	-.23	.13	.04	-.04	-.04	.06
S. D.			.22	.24	.22	.24	.23	.33	.15	.31	.12	.31	.34
P. E. of Med.		±	.0843	.1012	.0843	.0920	.0881	.0996	.0573	.1188	.0459	.1188	.1303
Med./P. E.			2.01	.296	2.37	2.06	1.02	3.31	1.38	.16	.00	.33	.46
Reliability			8.77	57.96	94.42	96.36	75.42	98.70	82.42	35.71	50.00	41.12	61.59
Medians Men and Women Combined.			.115	.125	.07	.20	.07	.03	.15	.00	.08	-.02	.06
Average			.05	.09	.12	.20	.08	-.07	.14	.04	.08	.01	-.01
S. D.			.23	.21	.17	.23	.22	.29	.18	.28	.18	.26	.29
P. E. of Med.		±	.0626	.0632	.0462	.0626	.0598	.0788	.0489	.0761	.0489	.0707	.0789
Med./P. E.			1.83	1.97	1.5	3.1	1.17	.38	3.06	.00	1.6	.27	.76
Reliability			89.64	90.79	84.41	98.17	78.64	60.11	98.03	50.00	85.97	42.77	69.58

It is readily observed that the results appearing in the tables are not unlike those secured for mood. The same wide difference is observable with regard to the performance of the separate individuals and with regard to the individual's own performance in the separate tests. Any agreement that might exist may be determined by counting instances of similarity of results. These instances expressed in per cents appear below together with corresponding per cents for Mood between which a comparison can readily be made:

TABLE XX
GROUPS I AND II

	Mood					Pulse			
	+	−	00	No. of Coefficients		+	−	00	No. of Coefficients
Women	50	31	2	83	Women	48	35		83
Per cts.	60	.38	.02		Per cts.	.58	.42		
Men	28	36		64	Men	33	30	1	64
Per cts.	44	.56			Per cts.	.52	.47	.01	
Total					Total				
M. & W.	78	68	2	147	M. & W.	81	65	1	147
	.53	.46	.01			.55	.44	.006	
	Systolic Blood Pressure					Pulse Pressure			
	+	−	00	No. of Coefficients		+	−	00	No. of Coefficients
Women	39	41	3	83	Women	38	13	3	54
Per cts.	.47	.49	.04		Per cts.	.71	.24	.05	
Men	39	23	2	64	Men	31	21	2	54
Per cts	.61	.36	.03		Per cts.	.56	.39	.04	
Total					Total				
M. & W.	78	64	5	147	M. & W.	69	34	5	108
	.53	.44	.03			.64	.32	.04	

Mood. For the women, including Group III, out of 160 correlation coefficients 88 or 55 per cent are positive, 70 or 44 per cent are negative while 2 or 1 per cent are zero. For the men including, Group III, out of 148 correlation coefficients 79 to 53 per cent are positive and 69 or 47 per cent are negative. For the group as a whole out of 308 correlation coefficients 167 or 54 per cent are positive and 139 or 45 per cent are negative and 2 or .006 are zero.

Taking Groups I and II for whom coefficients of correlation for circulation and performance have been worked out also, we observe that out of 83 coefficients 50 or 60 per cent are positive, 31 or 38 per cent are negative and 2 or 2 per cent are zero. For the men of these two groups out of 64 coefficients 28 or 44 per cent are positive and 36 or 56 per cent are negative. For the groups as a whole, out of 147 coefficients

78 or 53 per cent are positive, 68 or 46 per cent are negative and 2 or one per cent are zero.

Pulse. For the women, out of 83 correlation coefficients 48 or 58 per cent are positive and 35 or 42 per cent are negative. For the men, out of 64 correlation coefficients 33 or 52 per cent are positive and 30 or 47 per cent are negative. For the group as a whole, out of 147 correlation coefficients 81 or 55 per cent are positive and 65 or 44 per cent are negative while 1 or less than 1 per cent are zero. For the women there is a slight falling off in positive coefficients as compared with the results for mood; with the men there is a rather noticeable increase in positive correlation for pulse and performance. For the group as a whole the tendency is still toward an increase in positive coefficients but the difference is not considerable, 55 per cent as compared with 53 per cent in the case of Mood.

Systolic Blood Pressure. For the women, out of 83 correlation coefficients, 39 or 47 per cent are positive, 41 or 49 per cent are negative and 3 or 4 per cent are zero. For the men, out of 64 correlation coefficients, 39 or 61 per cent are positive, 23 or 36 per cent are negative and 2 or 3 per cent are zero. There appears a slight tendency toward a negative correlation with systolic blood pressure in the results for the women and a rather noticeable tendency toward a positive correlation in the results for the men. Considering the group as a whole, the positive tendency is less than for pulse, 53 per cent as compared with 55 per cent, but the same as that appearing in the results for Mood.

Pulse Pressure. (Group II only is included in these figures). For the women, out of 54 correlation coefficients, 38 or 71 per cent are positive, 13 or 24 per cent are negative and 3 or 5 per cent are zero. For the men, out of 54 correlation coefficients, 31 or 56 per cent are positive and 21 or 39 per cent are negative, and 2 or 4 per cent are zero. There is a marked increase in the results for both men and women in the number of positive coefficients. This same increase in noticed in the combined results, where out of 108 correlation coefficients 69 or 64 per cent are positive and 34 or 32 per cent are negative and 5 or 4 per cent are zero. This ratio of 2 to 1 in favor of positive coefficients is more marked than in the case of Pulse, Systolic Blood Pressure, or Mood.

The coefficients secured from correlating measures of cir-

culation with scores in the ten tests that are more definitely tests of performance were plotted in the form of a distribution curve. Table XXI gives the results of the distribution —the 25 percentile, the 75 percentile, the median, the P. E. of the median, Q and the range. Table XXII shows the correspondence of the actual distribution to the normal distribution. The range for Pulse Rate and Systolic Blood Pressure is about the same. It is somewhat narrower for Pulse Pressure due to the smaller number of measures represented in the distribution. The medians in all three measures of circulation are within .10 of zero, and the 25 percentile and 75 percentile of all three measures are within .26 of zero. Considering the sexes separately or combined, the actual distribution does not depart sufficiently from the normal distribution to indicate that mood had influenced results.

TABLE XXI

	25 Percentile	Median	P. E. of Median	75 Percentile	Q	Range	No. of Coefficients
PULSE RATE							
Women	−.114	+.083	±.032	+.28	.227	−.80 to +1.00	75
Men	−.178	+.032	±.023	+.221	.199	−1.00 to +1.00	58
Men and Women Combined	−.176	+.06	±.023	+.26	.218	−1.00 to +1.00	133
SYSTOLIC BLOOD PRESSURE							
Women	−.232	−.026	±.037	+.284	.258	−.82 to +.82	75
Men	−.149	+.10	±.048	+.344	.246	−1.00 to +1.00	58
Men and Women Combined	−.205	+.034	±.028	+.321	.263	−1.00 to +1.00	133
PULSE PRESSURE							
Women	−.029	+.08	±.024	+.243	.136	−.42 to +.42	49
Men	−.124	+.07	±.031	+.234	.179	−.56 to +.72	49
Combined	−.06	+.076	±.019	+.24	.15	−.56 to +.72	98

TABLE XXII

	−4Q	−3Q	−2Q	−1Q	+1Q	+2Q	+3Q	+4Q
Normal Distribution		.012	.067	.16	.50	.16	.067	.012	
PULSE RATE								
Women		.04	.04	.173	.533	.12	.066	.0133	.0133
Men	.034		.051	.172	.50	.155	.051		.034
Combined	.0226	.015	.045	.172	.518	.135	.067	.0073	.0226
SYSTOLIC BLOOD PRESSURE								
Women		.013	.04	.186	.50	.11	.066	.04	
Men	.034		.086	.137	.517	.171	.017	.034	
Combined		.022	.045	.187	.555	.097	.067	.022	
PULSE PRESSURE								
Women		.02	.12	.02	.612	.183	.04		
Men		.0204	.1022	.142	.469	.183	.061	.0204	
Combined		.051	.082	.102	.5204	.163	.051	.0102	.0102

Again to be consistent with the procedure adopted for the discussion of results in this study any relation between the various series of correlation coefficients must be observed by comparing medians.

Table XXIII shows the median coefficients in the separate tests for Mood, Pulse, Systolic Blood Pressure, and Pulse Pressure for Groups I and II.

It will be observed that in nine out of eleven tests the women tend toward a positive relation between performance and Pulse and Pulse Pressure, and in four tests toward a positive relationship with Systolic Blood Pressure. The men show a positive relation with Systolic Blood Pressure in nine of the eleven tests, with Pulse in four, with Pulse Pressure in six, and with Mood in two tests out of the eleven. For the men and women combined the tendency to positive correlation is evident in eight of the eleven tests with Mood and Pulse, in nine with Pulse Pressure and in seven with Systolic Blood Pressure.

Table XXIV gives the range of the median coefficients in the various tests with the median coefficients for the four relations.

For the women the range in Pulse and Systolic Blood Pressure is slightly wider than for Mood and about the same for Pulse Pressure. The median for Pulse is slightly higher than for Mood, for Pulse Pressure slightly lower and for Systolic Blood Pressure still lower. The range for the mean

TABLE XXIII

MEDIAN COEFFICIENTS
(Groups I and II)

	Women				Men				Men and Women Combined			
	Mood	Pulse	Systolic Blood Pressure	Pulse Pressure	Mood	Pulse	Systolic Blood Pressure	Pulse Pressure	Mood	Pulse	Systolic Blood Pressure	Pulse Pressure
Line	.21	.04	.22	.27	.04	.13	.13	−.17	.17	.10	.13	.115
Sensitivity	.23	.21	−.10	.125	−.065	−.085	.135	.03	.02	.02	.00	.125
Right Hand Grip	.13	.27	−.10	.06	−.10	−.08	.08	.19	.065	.19	.03	.07
Left Hand Grip	−.13	.21	−.06	.21	−.06	.00	.33	.19	−.095	.075	.195	.20
Tapping	.20	.22	−.19	.04	.08	−.19	.21	.10	.15	.02	−.06	.07
Color	.12	.18	.00	.08	−.06	.19	.02	−.33	.03	.19	.02	.03
Errors	.02	−.135	−.03	.23	−.13	−.08	−.06	.08	.02	−.08	−.06	.15
Adding	−.125	−.10	.075	.02	−.33	.27	.04	−.02	−.17	−.06	.04	.00
Errors	.115	.08	.075	.23	.19	.06	−.17	.00	.15	.08	.00	.08
Indiv. Reaction	.175	.02	.00	.00	−.08	−.28	.06	−.04	.05	−.02	.02	−.02
Avg. React. Time	.195	.14	.185	−.08	−.17	.02	.31	.06	−.10	.06	.295	.06
	9	9	4	9	2	4	9	6	8	8	7	9
	2	2	5	1	9	6	2	4	3	3	2	1
			2	1		1		1			2	1

TABLE XXIV

	Mood Range	Mood Difference	Mood Med.	Pulse Range	Pulse Difference	Pulse Med.	Systolic Blood Pressure Range	Systolic Blood Pressure Difference	Systolic Blood Pressure Med.	Pulse Pressure Range	Pulse Pressure Difference	Pulse Pressure Med.
Women	−.13 to .23	36	.13	−.13 to .27	40	.14	−.19 to .22	41	.00	−.08 to .27	.35	.08
Men	−.33 to .19	52	−.04	−.25 to .27	52	.02	−.17 to .33	50	.08	−.33 to .19	.52	.03
Combined	−.17 to .17	34	.05	−.08 to .19	27	.06	−.06 to .295	35	.03	−.02 to .20	.22	.07

in all four relations is wider than for the women and is practically the same for all four relations. The median position for Pulse and Pulse Pressure is higher than it is for Mood, and highest for Systolic Blood Pressure.

CHAPTER IV

SECTION II

MOOD AND WEATHER

In any investigation of mood the influence of the weather on feelings must be considered. In this experiment observations were made of the weather, the winter days being classified roughly as "Bright," "Average," and "Gloomy." As spring approached the days varied more in temperature and humidity making a slight difference in classification necessary. The days for this part of the experiment were classified roughly as "Bright-temperate," "Bright-cold," "Warm" and "Gloomy."

The mood recorded for the various days was located in its place among the scores already ranked as falling in the lower or the upper half of the range. As the difference between adjacent scores was not at all uniform any finer divisions would have to be made arbitrarily and on the whole would be of but slightly more value in revealing relations. In Table XXV are included the result for the subjects in Group II who took the tests from October 12 to Feb. 18. In Table XXVI are included the result for the subjects in Group III who took the tests from Feb. 28 to May 9.

The women of Group II made 100 judgments of mood covering a period of 21 days, seven of which were "Bright," seven "Average," and seven "Gloomy." Of the 31 judgments of mood on bright days 58 per cent were in the upper levels of

TABLE XXV

Mood in Relation to the Weather

Group II

	Women					Men				
	No. of days	Levels of Mood IV-III	Levels of Mood II-I	No. of Judgments		No. of days	Levels of Mood IV-III	Levels of Mood II-I	No. of Judgments
Bright	7	.58	.42	31	Bright	10	.60	.40	45
Average	7	.49	.51	35	Average	6	.33	.67	27
Gloomy	7	.27	.73	34	Gloomy	4	.53	.47	19
	21			100		20			91

TABLE XXVI
Group III

	Women				Men			Combined	Judgments No. of
	No. of days	Levels of Mood IV-III	II-I	No. of Judgments	No. of days	IV-III I-II Levels of Mood	No. of Judgments	Levels of Mood IV-III II-I	
Bright—Temperate	1	.90	.10	10	1	.50 .50	6	.75 .25	16
Bright—Cold	1	.50	.50	6	1	.62 .38	13	.58 .46	19
				16			19		35
Hot	1	.37	.63	8	1	.33 .67	12	.35 .65	20
Warm	1	.37	.63	8	1	.27 .73	11	.32 .68	19
Warm	1	.50	.50	6	1	.50 .50	8	.50 .50	14
Rather Warm	1	.33	.67	9	1	.46 .54	9	.39 .61	18
				31			40		71
Gloomy	1	.54	.46	9	1	.45 .55	11	.50 .50	20
Slightly Gloomy					1	.54 .46	9	.50 .50	18
Very Gloomy	1	.46	.54	9					
				18			20		38

cheerfulness and 42 per cent in the lower levels. Of the 35 judgments made on "Average" days, 49 per cent were in the upper levels and 51 per cent in the lower levels. Of the 34 judgments made on "Gloomy" days, 27 per cent were in the upper levels and 73 per cent in the lower levels of cheerfulness. The men of Group II made 91 judgments of mood covering a period of 20 days, ten of which were "Bright," six "Average" and four "Gloomy." Of the 45 judgments made on bright days 60 per cent were in the upper levels and 40 per cent in the lower levels of cheerfulness. Of the 27 judgments made on "Average" days, 33 per cent were in the upper levels and 67 per cent in the lower levels. Of the 19 judgments made on "Gloomy" days, 53 per cent were in the upper levels and 47 per cent in the lower levels of cheerfulness. The tendency is for both men and women to feel more cheerful on "Bright" days and less cheerful on "Average" and "Gloomy" days. The women seem to be more affected by gloomy weather than the men, who indicate the greatest influence on "Average" days. Possibly this may be explained by the fact that the "Average" days of this particular winter were seldom free from some of the conditions that prevailed on the "Gloomy" days.

The women of Group III made 16 judgments of mood, ten being made on a "Bright-temperate" day and six being made on a "Bright-cold" day. On the first, 90 per cent were in the upper levels of cheerfulness and 10 per cent in the lower levels. On the second, 50 per cent were in the upper levels and 50 per cent in the lower of cheerfulness. For the men and women combined of the 16 judgments made on the Bright-temperate day, 75 per cent were in the upper levels, and 25 in the lower levels. Of the 19 judgments made on the "Bright-cold" day 58 per cent were in the upper levels and 46 per cent in the lower levels of mood.

The opposite relation exists for the four "Warm" days. Of the 71 judgments made on three of the warm days, the smallest per cents are in the upper levels, the per cent in the lower levels of cheerfulness being more than one and one-half as great as in the upper levels. On one of these days there is no difference in the per cents for either women or men.

On the slightly "Gloomy" days the women of this group gave more judgments in the upper levels of cheerfulness, the per cent being 54, as opposed to 46 per cent in the lower. On

the very "Gloomy" day, the relation is reversed, 46 per cent of the judgments being in the upper levels and 54 per cent in the lower levels. The men of this group as was the case with the men of group II tend to be lower in mood on slightly gloomy days than they are on definitely gloomy days. In the first instance, 45 per cent of the judgments are in the upper levels as against 55 per cent in the lower and in the instance, 54 per cent are in the upper as against 46 per cent in the lower levels of mood. Considering the men and women of this group combined the judgments are equally divided between the upper and lower levels of cheerfulness.

Concluding then from the data here presented there appears to be a rather definite relation between mood and weather, a cheerful mood tending to prevail on bright, pleasant days and various degrees of depression on gloomy, disagreeable days.

These results are in harmony with those found by Dexter in an empirical study of the mental and physiological effects of meteorological conditions. According to this investigator emotional states are plainly influenced by the weather states, "hot, humid, cloudy, wet days," although making us "feel out of sorts and liable to be troublesome, show the least number of misdemeanors owing to the fact that the energy is lacking to carry out the emotion because of the depleting effect of the weather."

BIBLIOGRAPHY

1. Ach, N. — Uber den Willensakt und das Temperament.
2. Baldwin. — Dictionary of Philosophy and Psychology.
3. Cannon. — Bodily Changes in Pain, Fear and Rage.
4. Cattel, J. McK. — A Statistical Study of American Men of Science. Science N. S. Vols. 24 and 32.
5. Cobb, Margaret. — Archives of Psychology No. 50.
6. Cogan, L. C., Conklin A., and Hollingworth, H. L. — An Experimental Study of Self-Analysis. School and Society, 1915. 2. P. 171.
7. Crile. — The origin and Nature of the Emotions.
8. Davenport, C. B. — Heredity of Constitutional Mental Disorders. Psych. Bull., 1920.
9. Dexter, Edwin, G. — Conduct and the Weather. Psych. Rev. Mon. Supp. No. 10, 1899.
10. Gley. — Internal Secretions.
11. Hollingworth, H. L. — Experimental Studies in Judgment. Arch. of Psych. No. 29.
12. Hollingworth, H. L. — The Influence of Caffein on Mental and Motor Efficiency. Arch. of Psych. No. 22. P. 13.
13. Hollingworth, H. L. — Correlation of Abilities as Affected by Practice. Jr. of Educ. Psych. Sept. 1913.
14. Hollingworth, L. S. — Functional Periodicity. Teachers College, Columbia University Contributions to Education, No. 69.
15. James. — Principles of Psychology.
16. Janeway. — Lecture Notes on Physiology—The Ductless Glands.
17. Kent-Resanoff. — A Study of Association in Insanity. Amer. Jr. of Insanity. LXVII.
18. McPhail, A. H. — Adenoids and Tonsils: A Study Showing how the Removal of Enlarged or Diseased Tonsils Affects a Child's Work in School. Ped. Sem. June, 1920. Pp. 188-194.
19. Morgan, J. J. B. — The Overcoming of Resistances and Other Distractions. Arch. of Psych. No. 35.
20. Pressey & Chambers. — A. Scale for Investigating the Emotions. Jr. of Appl. Psych. 1920. 4: 92-104.
21. Poffenberger, A. T. — Influence of Practice on Mental Processes. Jr. of Educ. Psych. Vol. 6. 1915, P. 462.
22. Rugg, H. O. — Is the Rating of Human Character Practicable? Jr. of Educ. Psych. Nov., Dec., 1921, Jan., Feb. 1922.
23. Sherrington. — The Integrative Action of the Nervous System.
24. Stecher, Lorle I. — The Effect of Humidity on General Efficiency. Arch. of Psych. No. 38 P. 12.
25. Strong, E. K., Jr. — Effect of Hookworm Disease on the Mental and Physical Development of Children. Publ. of the International Health Commission. The Rockefeller Foundation, New York. 1916. 3. P. 121.
26. Thorndike, E. L. — Mental and Social Measurements. P. 194.
27. Thorndike, E. L., McCall W. A., and Chapman, J. C. — Ventilation in Relation to Mental Work.
28. Thorndike, E. L. — Mental Fatigue. Psych. Rev. 1900. Vol. 7., P. 481.
29. Wallin. — The Mental Health of the School Child. Chap. XIII.

30. Webb, E. Character and Intelligence. An Attempt at an Exact Study of Character. British Jr. of Psych. Mon. Suppl. Vol. I No. 3.
31. Woodworth. Psychology. Chap. XXI.
32. Woodworth and Wells. Association Tests. Psych. Mon. No. 57.
33. Woodworth. The Accuracy of Voluntary Movement. Psych. Rev. Suppl. No. 13.
34. The Scott Company Laboratory. Reprint from the Journal of Applied Psych. Vol. IV. 1920. Pp. 115-125.

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Quarterly. Pedagogy and educational psychology. Founded 1891.

Psychological Review—Princeton, N. J.: Psychological Review Company.
Subscription $4.25. 480 pages annually.
Bi-monthly. General. Founded 1894. Edited by Howard C. Warren.

Psychological Bulletin. Princeton, N. J.: Psychological Review Company.
Subscription $5. 720 pages annually. Psychological literature.
Monthly. Founded 1904. Edited by Shepherd I. Franz.

Psychological Monographs. Princeton, N. J.: Psychological Review Company.
Subscription $5.50 per vol. 500 pp. Founded 1895. Ed. by James R. Angell.
Published without fixed dates, each issue one or more researches.

Psychological Index. Princeton, N. J.: Psychological Review Company.
Subscription $1.50. 200 pp. Founded 1895. Edited by Madison Bentley.
An annual bibliography of psychological literature.

Journal of Philosophy—New York; Sub-Station 84.
Subscription $4. 728 pages per volume. Founded 1904.
Bi-weekly. Edited by F. J. E. Woodbridge and Wendell T. Bush.

Archives of Psychology. Sub-Station 84, New York: Archives of Psychology.
Subscription $5. 500 pp annually. Founded 1906. Edited by R. S. Woodworth.
Published without fixed dates, each number a single experimental study.

Journal of Abnormal Psychology and Social Psychology—Boston.
Subscription $5. Richard G. Badger. Edited by Morton Prince.
Bi-Monthly. 432 pages annually. Founded 1906. Abnormal and social.

Psychological Clinic. Philadelphia: Psychological Clinic Press.
Subscription $2.50. 288 pages. Ed. by Lightner Witmer. Founded 1907.
Without fixed dates (9 numbers). Orthogenics, psychology, hygiene.

Training School Bulletin. Vineland, N. J.: The Training School.
Subscription $1. 160 pages annually. Edited by E. R. Johnstone. Founded 1904.
Monthly (10 numbers). Psychology and training of defectives.

Journal of Educational Psychology. Baltimore: Warwick & York.
Subscription $4. 540 pages annually. Founded 1910.
Monthly (9 numbers). Managing Editor, Harold O. Rugg.
(Educational Psychology Monographs.
Published separately at varying prices. Same publishers.)

Comparative Psychology Monographs—Baltimore: Williams & Wilkins Co.
Subscription $5. 500 pages per volume. Edited by W. S. Hunter.
Published without fixed dates, each number a single research.

Psychoanalytic Review. Washington, D. C.: 3617 10th Street, N. W.
Subscription $6. 500 pages annually. Psychoanalysis.
Quarterly. Founded 1913. Edited by W. A. White and S. E. Jelliffe.

Journal of Experimental Psychology—Princeton, N. J.
Psychological Review Company. 480 pages annually. Experimental.
Subscription $4.25. Founded 1916. Bi-monthly. Ed. by John B. Watson.

Journal of Applied Psychology. Worcester, Mass.: Florence Chandler.
Subscription $4. 400 pages annually. Founded 1917.
Quarterly. Edited by James P. Porter and William F. Book.

Journal of Comparative Psychology—Baltimore: Williams & Wilkins Co.
Subscription $5. 500 pages per volume. Founded 1921.
Bi-monthly. Edited by Knight Dunlap and Robert M. Yerkes.